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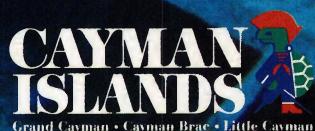
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Breathe easy: ScubaLab finds great regs for every budget.



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66 Best New Regs ScubaLab puts 24 models on a state-of-the-art breathing machine and in the water with a team of test divers to find the cream of a new crop. *By John Brumm*

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Cover photo by Doug Perrine

RODALE'S

SCUBA DIVING

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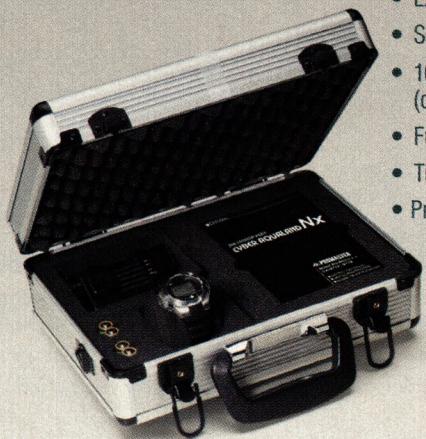
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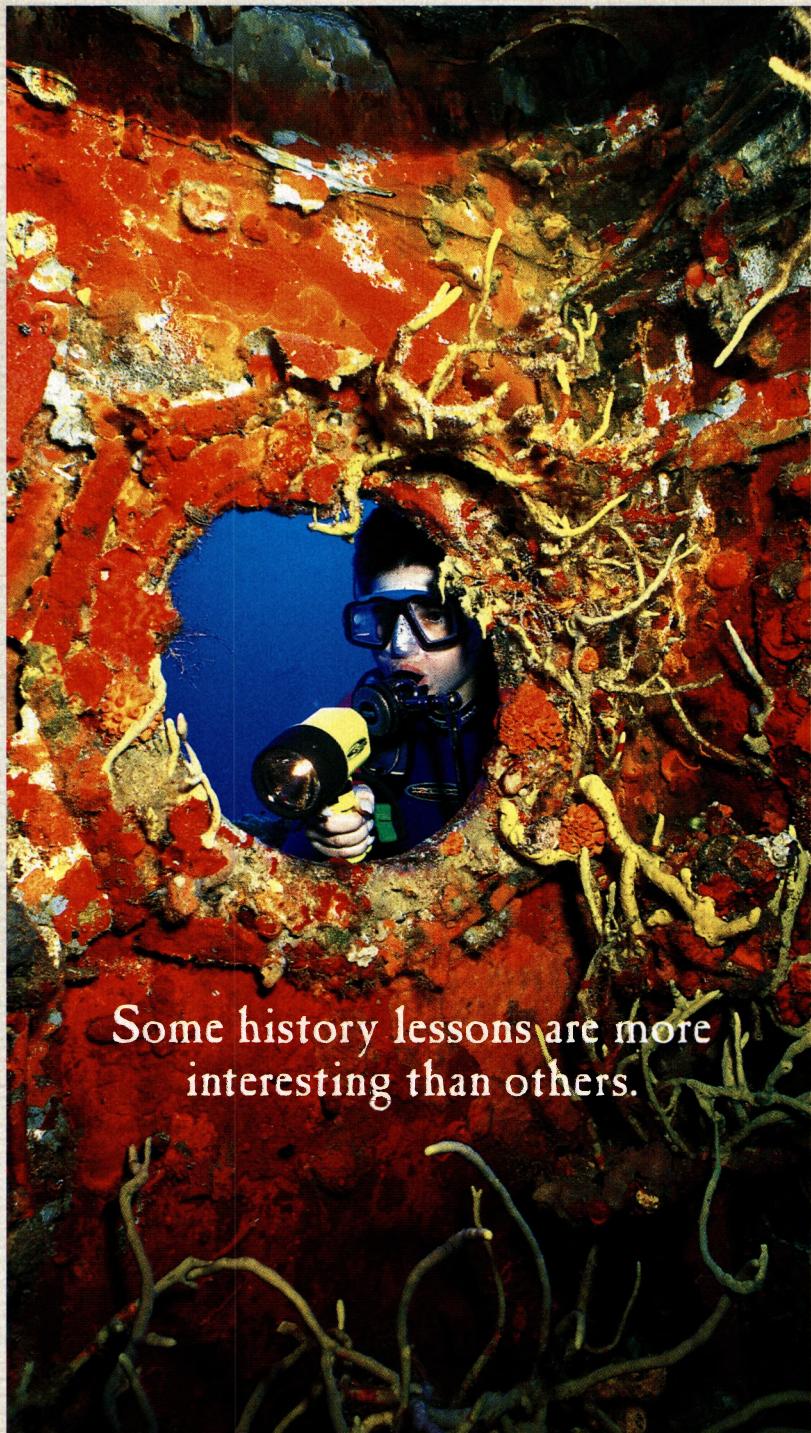


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Some history lessons are more
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From the HMS Looe, which ran aground in 1744, to the recently-sunk Spiegel Grove, now the largest artificial reef in the world, The Florida Keys has a rich history to explore underwater. Problem is, deciding where to start could make you a wreck.

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(EDITOR'S NOTE)

A Community of Divers

Where you can get that back-of-the-dive-boat feeling every day of the year. **BY BUCK BUTLER**

A DAY IN THE LIFE of the Diver-to-Diver message board at www.scubadiving.com is, in many ways, like a day in the life of any other community. All day long, people tell stories, share experiences, recite jokes, engage in petty arguments and dole out advice of wildly varying quality.

A community is defined by its common bond, and the glue that holds this one together is a love of diving. On an average day, these computer-bound divers post more than 500 messages, grouped by topic in threads, some of which contain dozens of messages, while others consist of a single wisecrack.

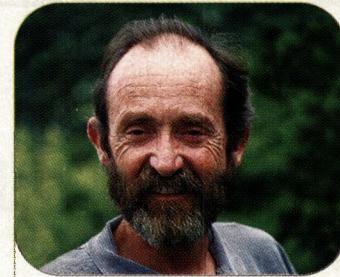
As with other communities, this one fosters feelings of kinship among its members that transcend their common passion for the sport and speak to their common humanity. When the daughter of a Diver-to-Diver regular was seriously injured in an accident last year, the users of the board hosted an online auction to benefit the girl. And since a message board regular was killed in a tragic car accident earlier this year, members of the board—most of whom knew him only through his postings—have spread his ashes at dive sites around the world.

Sometimes, the users of the Diver-to-Diver message board even break out of cyberspace and get together in physical space, whether it's for dinner and drinks in Chicago or for a group trip to Cozumel. And then when they get back to their respective computers, they share the pictures, exaggerate their encounters and plan their next outings.

Isn't it time you joined the discussion? Go to www.scubadiving.com and click on "Community."



We are family: Message board users from around the U.S. and Canada joined a September dive trip in California.



(CONTRIBUTOR)

JOHN FRANCIS

Scuba Diving's training editor tackles a familiar subject in "A Day at the Beach," pg. 89. A native Californian, John has been perfecting his own surf diving technique for years. After all, this is the kind of thing California divers learn early, practice often and debate fiercely over fish tacos. John hit the popular scuba beaches to gather a full range of opinions from his fellow divers and found agreement on at least one point. "Beach diving is, in the words of my informants, 'cool,' 'sweet,' 'awesome' and, yes, 'bitchin,'" he says. "And did I mention it's just about free?"

(ONLINE)

Virtual DEMA

From Oct. 8-11, the dive industry takes over the Miami Beach Convention Center for the 2003 Diving Equipment & Marketing Association (DEMA) show. The show is open only to industry insiders, but ScubaDiving.com has your sneak peek at the hottest new gear, the coolest dive trips for 2004, and the good times that happen when more 14,000 divers get together in one place. Visit ScubaDiving.com today to see what's going down at this year's show.

(LETTERS)

Priceless Bugs

MY WIFE HEARTILY AGREES with your characterization of a bagful of Florida lobsters as "the dive world's most expensive free meal." But, as Bucky McMahon found out ("Lobster Madness," Oct. '03), to think of the lobster mini-season as a way to save a few bucks on a nice dinner is to miss the point. This year marks the fourth in a row that my three best dive buddies and I have made the pilgrimage to the Keys to

drink a few beers, make a few dives and eat a few bugs. It's become one of the highlights on my calendar every year, and even though Mr. McMahon was reluctant to say it, and my wife will probably never fully understand it, the chance to spend three days in dive paradise with some like-minded friends is ... priceless. **Howard Strachan, Clarksville, Tenn.**



(HOW TO REACH US)

We want to know what's on your mind. Here are three easy ways to tell us:

E-MAIL: edit@scubadiving.com
FAX: (912) 351-0735
MAIL: Editor, Rodale's Scuba Diving, 6600 Abercorn St., Suite 208, Savannah, GA 31405

Deep Sheep

I APPRECIATED JOHN FRANCIS'S ARTICLE about the most important lessons he's learned in his diving career ("Six Things I've Learned in 23 Years of Diving," Oct. '03). I especially applaud his second lesson, "Don't Play Follow the Leader." I've been on many dives where the group follows the divemaster like a flock of sheep. I always go my own way and inevitably find critters and have encounters that the rest of the divers miss out on. Such was the case in southern Belize recently, where my buddy and I trailed the group by 100 yards and watched a pair of whale sharks cruise between us and the rest of the divers, who were too busy watching the divemaster's fins to see what they were missing. **Wil Felton, Norwich, Conn.**

(THE NUMBERS)

FISH GEEKS

10%

Percentage of divers who say they can identify more than 100 fish species by sight.

MORAL MAJORITY

84%

Percentage of divers who say they've never exaggerated how much dive experience they have.

BOAT PEOPLE

31%

Percentage of divers who have been on at least one live-aboard dive trip.

AN OUNCE OF PREVENTION

46%

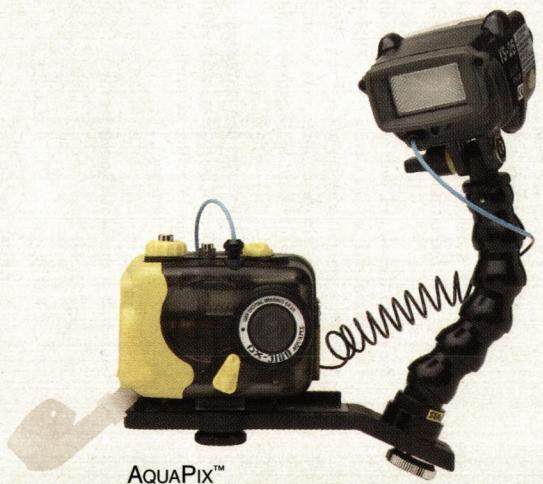
Percentage of divers who usually carry a spare mask on dives.

(Source: Surveys of users on www.scubadiving.com)

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Dear Reader,

For more than 60 years, Rodale has been at the forefront of inspiring and enabling people to improve their lives and the world around them. We like to say that through our numerous books and magazines, we are there for people their *whole* lives: in health and sickness, in action and in contemplation, at any age. In fact, this month, every magazine we publish addresses one of the most critical and preventable health issues facing our nation: **childhood obesity**.



According to a recent study*, nearly 10 million children in America are either medically obese or on the verge of becoming so. Without question, fast food, poor eating habits in general, and limited activity are key contributors to childhood obesity. Unfortunately, there are no quick cures, but there are highly effective tools that can be incorporated into a child's lifestyle, particularly with the help of a caring adult. Through our reporting and through The Rodale Institute's® children's Internet magazine www.kidsregen.org**, we're giving you these tools, and we encourage you to put them into practice if a child you know is in trouble or headed toward it. And if you think it's just something they'll "grow out of," here are a few facts that should serve as a call to immediate action:

- Obesity—having reached epidemic proportions—is second only to tobacco use in preventable deaths in the U.S., according to the Centers for Disease Control and Prevention (CDC).
- Obesity rates in adolescents have tripled in the past 20 years, reports the American Heart Association.
- A number of significant studies show that childhood obesity leads to other physical problems such as diabetes, heart disease, and even some types of cancer.
- Obesity sets kids up for a lifetime of self-esteem problems and can lead to clinical depression, according to a *Journal of the American Dietetic Association* report.
- A new *Prevention*® Magazine Children's Health Study revealed that, while 63% of our nation's youth watch television five or more days per week, 66% of kids reported that they would like to be exercising with their parents.

We'd also like to call your attention to a national ABC News television event we are collaborating on entitled "Fat Like Me." This special will air on October 27, 2003 (8 p.m. EST/10 p.m. PST), and we strongly encourage every person in your family to watch. Even if obesity has not affected you or your family directly, it's likely you know someone who is struggling with the disease. In addition to all of the tangible steps we are asking children to take, learning how to deal with weight issues wisely and sensitively will go a long way toward healing the painful emotional component of the disease. There truly are lessons here for us all.

As we commit the resources of our company toward combating this disease, we are asking for your help. Get involved in the lives of America's youth, and help them lead healthier lives. To share your thoughts and ideas with us, please visit www.rodale.com. We've also posted additional resource information about this important issue as well as editorial coverage from other Rodale publications. We'd love to hear from you!

On behalf of the entire Rodale family,

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**Prevention*® Magazine's Children's Health Study, June 2003.

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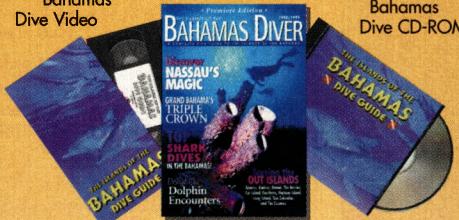


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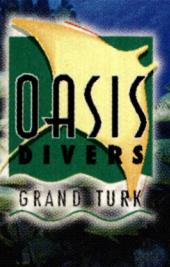
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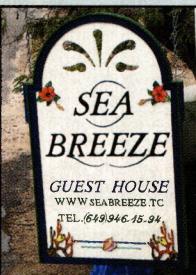
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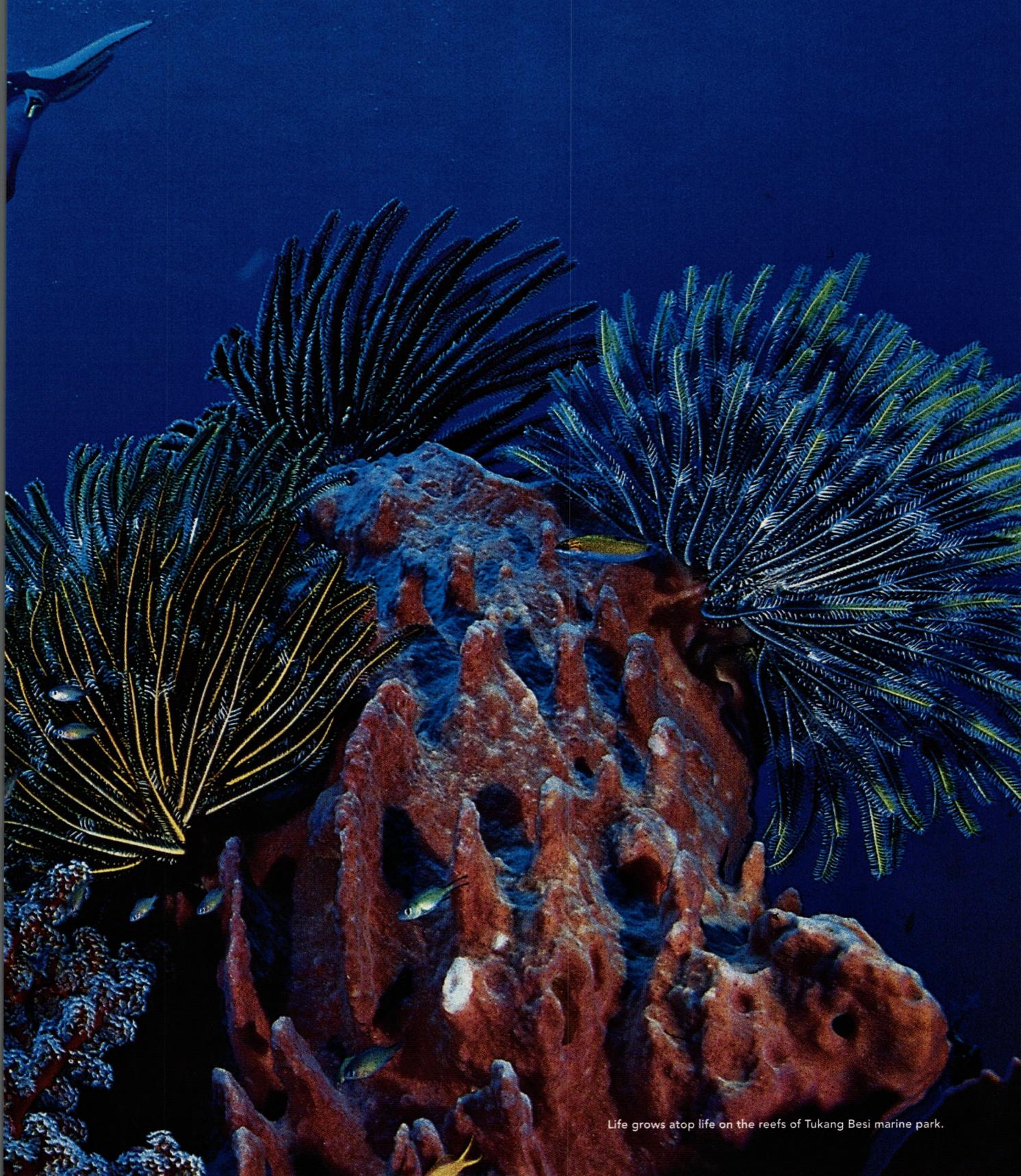
PHOTOGRAPH BY NORBERT WU

(SULAWESI, INDONESIA)

Wakatobi

IT'S ESTIMATED THAT FEWER than 1,000 divers have experienced Wakatobi's reefs, which surprises no one who has made the trip. From the U.S., you'll probably make two stopovers, in Singapore and Bali. But this far-flung Pacific island is definitely worth the trouble. Located in the remote Tukang Besi archipelago in southeast Sulawesi at the edge of the Banda Sea, Wakatobi's reefs are among the most pristine and prolific in the world. Scores of tropical reef fish species—fusiliers, pyramid butterflyfish, sergeant majors, houndfish, redtooth triggerfish—swirl around divers in the coral shallows. Turtles, eagle rays and bumphead parrotfish favor the reef's canyons. Wire corals, seafans and sponges cling to steep sloping walls. Check the deep blue for the pilot whales, dolphins, sharks and tuna that frequent these waters.





Life grows atop life on the reefs of Tukang Besi marine park.

Crustaceans, hermit crabs and nudibranchs thrive in the cathedral-like protection of an underwater cave off Ustica.

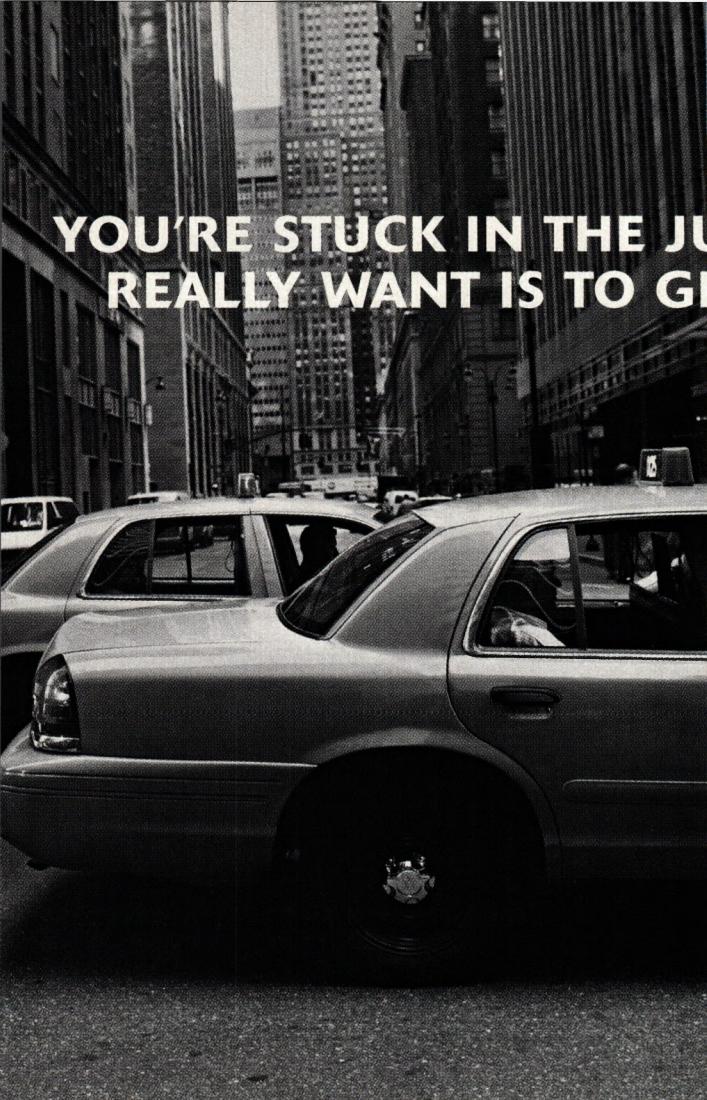
(ITALY)

Ustica

FROM A DISTANCE, Ustica, a tiny island 36 miles off the northwest shore of Palermo, rises like a huge turtle in an intensely turquoise-blue sea. The island is often referred to as "the Black Pearl of the Mediterranean," and it's easy to see why. Located in the heart of the Mediterranean's Tyrrhenian Sea, Ustica's three black cones are the remains of what was once a vast volcanic chain. The volcanic legacy continues under water, where a fascinating bottomography keep divers busy. Recently, Ustica's waters were designated as a marine reserve, Italy's first, and rainbow wrasses, pilot-fish, swordfish, dolphins, tuna and groupers have all flourished under the protection. **SD**

GET THERE > For more

information on these great dives, turn to In Depth, page 103, section 1.



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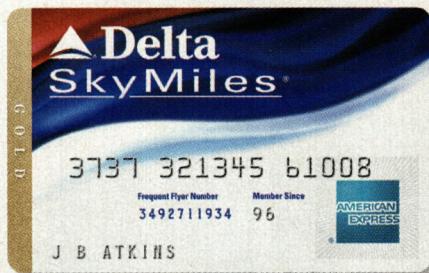
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A photograph of an underwater coral reef. In the upper right, a large brown sea fan or gorgonian coral is visible. In the lower right, a scuba diver wearing a blue wetsuit and a yellow buoyancy compensator (BCD) is looking towards the camera. They have a white tank and a black regulator. A bright light from their dive light illuminates the surrounding water. The reef itself is composed of various corals, including large green brain corals and smaller red and orange polyps.

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Curre



Her shark dive completed, supermodel Heidi Klum tries her hand at behind-the-scenes catering.

n t s



COURTESY OF DISCOVERY CHANNEL

(PEOPLE)

Beauty and the Beasts**Heidi Klum charms the sharks.**

As one of the world's most photographed fashion models, Heidi Klum has learned how to deal with sharks—at least the two-legged variety.

This summer, the *Sports Illustrated* cover girl got the chance to swim with real sharks as part of the Discovery Channel's *Shark Week*. But before the cameras could roll, the five-foot, nine-inch beauty had to earn her C-card. And according to the team at Stuart Cove's Dive Bahamas, the supermodel did just fine.

"She was amazing," says Michelle Cove. "Whatever we asked her to do, she plunged right into it."

With her checkout dives completed, Klum joined Stuart Cove and *Shark Week* host Nigel Marven on a feeding dive for the "Sharks Under Glass" program, which aired in August.

"They handed me the bait and I was able to feed the sharks myself. That was a thrill," says Klum. The dozen sharks that surrounded the area must have enjoyed the model's touch. They followed her to the surface where she was able to hand-feed them from the dive deck. —SCOTT D. JONES

(QUOTE)

We're in the Stone Age compared to nature.

—MATERIALS SCIENTIST GERI RICHMOND
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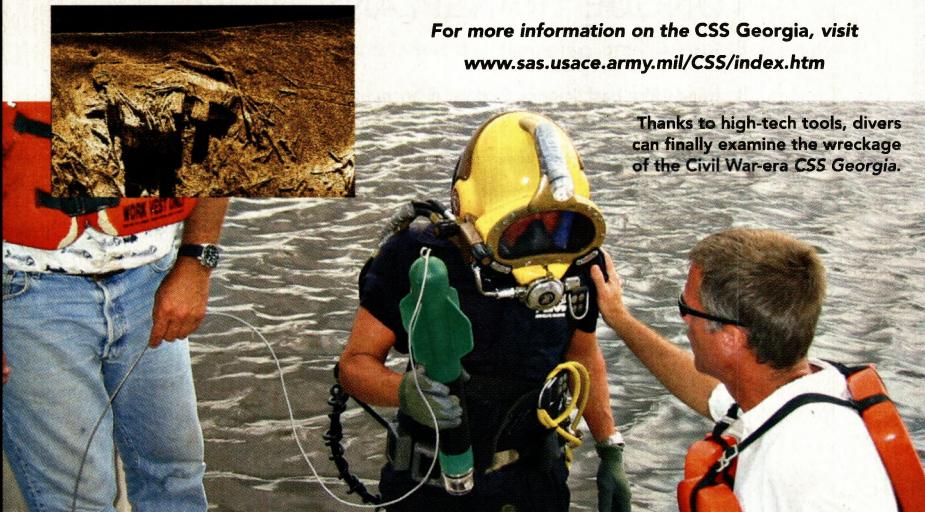
CUTTING THROUGH THE MURK

Sonar technology overcomes bad vis.

Ever since the Confederate ironclad CSS Georgia slipped beneath the surface of the Savannah River in 1864, the ship's remains have eluded every attempt at serious study. The river's swirling tidal currents and brackish water reduce visibility to just a few inches. Erv Garrison, a researcher who attempted to survey the wreck in the 1980s, described it as "archaeology by Braille."

But when divers visited the wreck near Savannah, Ga., this past summer, they were armed with active pulse sonar that cut through the murk to guide divers to the wreck. "Under reasonably good conditions ... you can get an almost photographic image of what's on the bottom," says Gordon Watts, head of one of the two underwater archaeological firms contracted by the U.S. Army Corps of Engineers to map the wreck.

By pinpointing areas of the wreck and marking locations with a GPS unit, the teams will produce a highly detailed map of the *Georgia*. That map will help determine how best to preserve the historic warship before the Corps begins deepening the river's shipping channel. —MICHAEL JORDAN



For more information on the CSS Georgia, visit
www.sas.usace.army.mil/CSS/index.htm

Thanks to high-tech tools, divers can finally examine the wreckage of the Civil War-era CSS Georgia.

MICHAEL JORDAN (DIVER); KLEIN ASSOCIATES, INC. (SONAR IMAGE)

(JUST IN)

The Eco-Friendly Boat

Imagine your favorite dive boat. Now imagine it without the diesel fumes. In Newport Beach, Calif., a water taxi service is testing a 30-foot electric boat powered by hydrogen fuel cells. Fuel cells convert hydrogen into electricity with only one by-product—water vapor. The test will also evaluate the effectiveness of an on-board generator that converts borax into pure hydrogen to power the fuel cells.

(CHARITY)

Santa's Diving Elves

Texas divers deliver a merry Christmas.

Imagine long lines of children, a soccer ball, a stuffed animal, the Christmas season. Think you're in a mall? Try a United Methodist church annex in Utila, Honduras, where hundreds of boys and girls wait in line for divers to pass out school supplies, personal hygiene products and, of course, toys.

For Texas diver Jimmy Atkinson, founder of Toys for Children, the holidays are a chance to spread a little cheer by distributing donated gifts in popular dive destinations. "Our goal every year is the same: to take as much as we can and give it to as many kids as we can," he says.

Last year, Atkinson and crew played Santa Claus to more than 1,000 children between the ages of 2 and 14 in Costa Rica, Honduras and Mexico. Over the past six years, they've distributed gifts to 7,500 children.

Dive clubs across the country pitch in with donated gift items, and the project is supported by an annual raffle of dive gear and resort packages donated by manufacturers and resorts. All donations and money raised go into buying and shipping the gifts—the volunteers who hand them out pay their own way for the privilege of being one of Santa's elves Atkinson says. "It only takes one exposure and then you're pretty much hooked." —

PAULA BAUMGARTNER

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CURRENTS



Say "ahh ..."

(FOOD CHAIN)

TONGUE TRANSPLANT

Blood-sucking parasites replace the real thing.

It sounds like bad science fiction: A hermaphroditic parasite consumes, then becomes the tongue of its infected host, reproducing more of its kind while keeping the host alive.

Proving that fact is indeed stranger than fiction, biologists have discovered this very relationship between isopod crustaceans and rose snapper in the Sea of Cortez. While parasitic isopods usually attach themselves to the outer scales or gills of a fish, they sometimes seek shelter inside the mouth. "Some eventually settle on the tongue," says Matt Gilligan, a marine scientist at Savannah State University.

Latching on, the tiny isopod sucks blood from its host and begins to grow. Eventually the tongue withers, leaving only a stub from which the isopod, now slightly larger than the original tongue, remains fastened. Incredibly, the infected fish seem healthy, suggesting the isopod takes over the role of the missing organ. —LANCE LEONHARDT

(STAT)

90%

Share of Florida's annual lobster catch taken in the Florida Keys. The statewide catch averages about 6 million pounds, but dipped as low as 3.1 million pounds in 2002. Sport divers take about 1.7 million pounds of lobster each year; 500,000 pounds during the two-day mini-season.

(MONEY)

Marathon Man

Charity dive raises \$208 per hour.

As a lieutenant in the Savannah, Ga., police department, Gary Glemboski is used to working the occasional long shift—but not like this. On a recent weekend, Glemboski volunteered for a 24-hour tour of duty on the bottom of a high school swimming pool.



His marathon scuba dive was a fund-raiser for the daughter of a fellow police officer. Alyssa Ennis was recently diagnosed with leukemia, and the \$5,000 raised will help pay for a bone marrow transplant. That works out to about \$208.33 for each hour Glemboski spent tossing an underwater frisbee, running a scuba obstacle course and counting the tiles in the pool—all 3,128 of them.

The dive was supervised by Michael Ange, technical editor of *Scuba Diving*, and supported by Glemboski's dive buddies who worked in round-the-clock shifts as safety divers. "They helped me stay awake and kept me moving," said Glemboski. "They were great."



MICHAEL ANGE



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A photograph of a large white multi-decked cruise ship docked at a tropical island. The island has lush green vegetation and a sandy beach. In the background, there are more islands under a clear blue sky. The water is a vibrant turquoise color.

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(ARTIFICIAL REEFS)

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The U.S. Maritime Administration (MARAD) "ghost fleet" of more than 400 obsolete vessels, many dating back to World War II, is anchored in three backwater ports where the agency spends millions each year just to keep them floating. Scrapping the vessels is no longer an option, and a Rand Corporation study showed reefing ships is the cheapest and most ecologically safe disposal option. Congress agreed and authorized MARAD to spend \$11 million to help fund artificial reef projects. Sport-fishing groups are actively pursuing wrecks, but divers aren't, says reefing advocate Jay Straith.

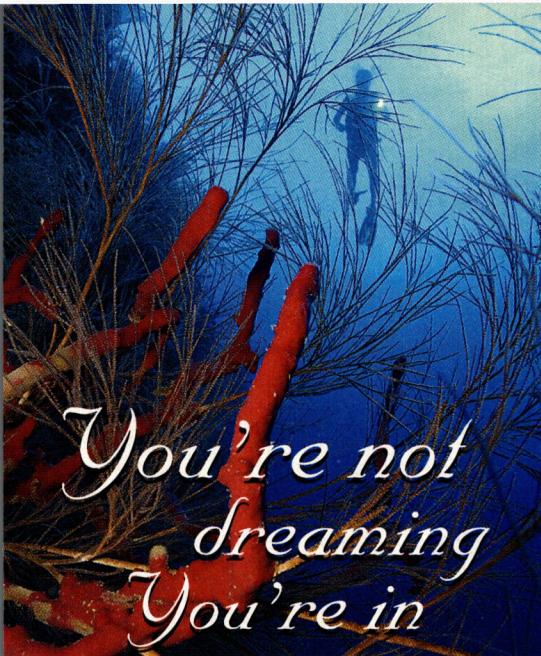
A former director of the Artificial Reef Society of British Columbia and now a reefing consultant, Straith has been turning surplus Canadian ships

into eco-friendly, dive-ready artificial reefs for more than a decade, including the popular Yukon wreck off San Diego.

"It is amazing how comparatively small markets in Canada and Australia have managed to successfully place 15 warships in 15 years, yet the U.S. dive industry finds this out of reach," says Straith. "We had hoped the success of the Yukon would have inspired divers' organizations across the country, but that seems not to be happening."

Diving pioneer Dick Long, who organized the Yukon project, is also perplexed. Creating new artificial reefs could save U.S. taxpayers a fortune, bolster marine life and boost dive tourism. "Reefing ships for divers makes too much sense," he says.

Four hundred new wreck dives could revitalize the sport, says Straith. The ships are available. Where are the divers? —MICHAEL LOVECCHIO



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For more information on items in Currents, turn to In Depth, page 107, section 6.

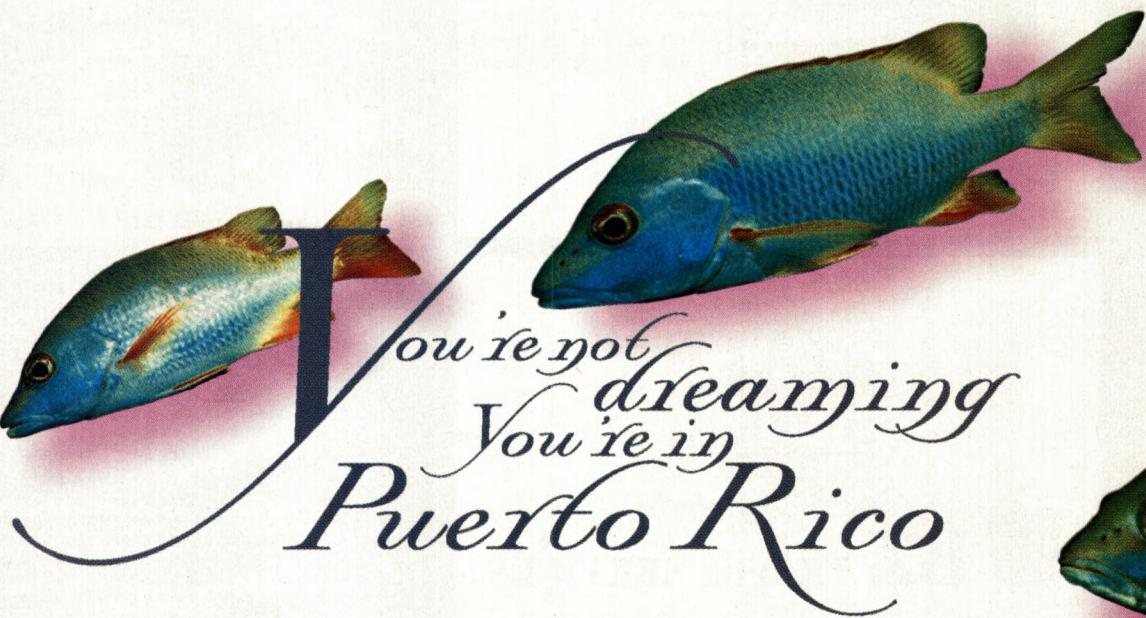


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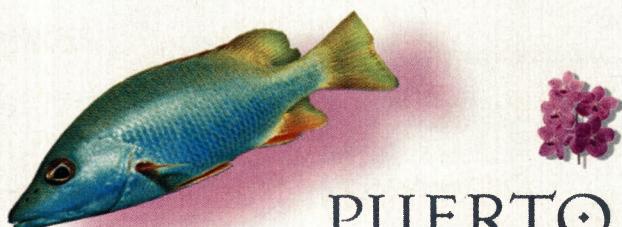


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LIFE

(FISH ID)

WHAT'S THIS?

This bottom-dweller also comes in white, pink, tan, brown and even black varieties, and each fish can change its color pattern slightly by shedding its skin at regular intervals. Like its lionfish and frogfish cousins, it blends into the background—often alone, though sometimes in pairs—snacking on unsuspecting prey. Sharp-eyed divers will find this fish hiding in the crevices of Pacific reefs from East Africa to Hawaii, and from Japan to Australia. The best clue to its identity? Skip the exaggerated dorsal fin and check out the plant-like appendages right between the eyes.

*the ANSWER*THE ANSWER: Leaf scorpionfish, *Taenianotus triacanthus*.

the D I F F E R E N C E

Think you can tell an angel from a butterfly? We'll show you how to be sure.

With bright colors and bold markings, angelfishes and butterflyfishes are among the first fish species many novice fish-watchers learn to identify. Yet distinguishing between the two families can sometimes be difficult. They both have oval- or disc-shaped bodies and are compressed from side to side. In fact, ichthyologists included

them in the same family for many years.

In the Caribbean, butterflies and angels are generally easy to tell apart. Most of the angelfishes are large, usually at least eight inches in length, and they swim gracefully above the reef. Butterflyfishes, on the other hand, are smaller, usually four inches or less in length, and—reminiscent of their namesakes—flit about the reef. But two uncommon Caribbean angelfish species, the cherubfish and flameback angelfish, throw

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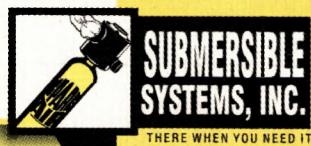
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those easy distinctions out the window. Neither grows much more than three inches in length, and both tend to flit about the reef like butterflies.

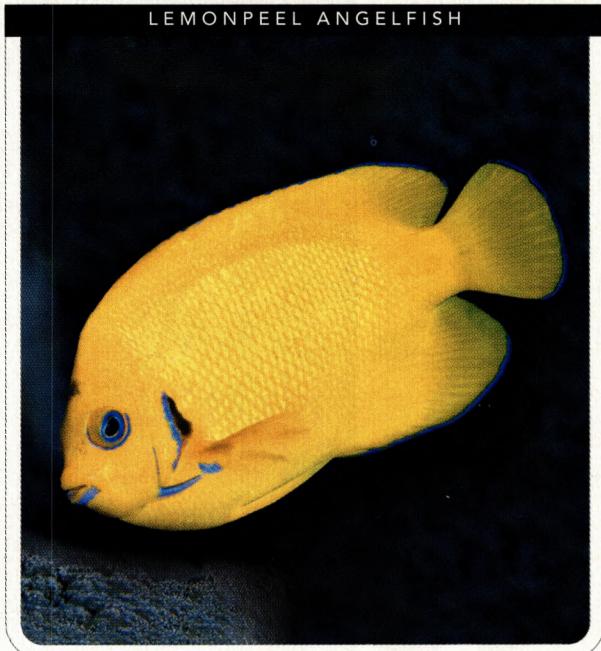
Move to the reefs of the tropical Indo-Pacific, and the problem becomes even more pronounced. There are nearly 60 species of angelfishes in the tropical Pacific and Indian Ocean, and almost half of them grow to no more than four inches in length. And although most of the 80 or so species of butterflyfishes are also around four inches, several species can grow to between six and 10 inches. Consequently, size and swimming movements alone cannot be used to distinguish between

the families. Besides having similar shape and size, both families have many members that are predominantly yellow, which also adds to the confusion.

Nonetheless, close attention to detail can give the fish-watcher a foolproof method of telling the two apart.

All angelfishes have a sharp spine extending from the lower rear gill cover, a physical feature never found on butterflyfishes. Another good clue, but not foolproof like the spine, is that most butterflyfishes have a dark bar passing through the eye, while only a few angelfishes have a similar marking. —PAUL HUMANN AND NED DELOACH

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Travel



DIVE GUIDE

Untamed Costa Rica

At the intersection of big animals and big adventure, the wild Osa Peninsula finds itself at another kind of crossroads. **BY PAUL KVINTA**

THE TWO QUESTIONS I HAVE, after our first day of diving Costa Rica's remote Osa Peninsula, are these: Where did all the whales come from, and who the hell built that cell tower?

First, the whales. We're at a dive site called Bajo del Diablo no more than 10 sec-

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Where the wild things are: The reefs of the Osa Peninsula pulse with a diverse blend of marine life, from schooling jacks to playful cetaceans.

onds when a frenzied mob of leviathans practically leaps into the boat with us. "Balleena! Balleena! Balleena!" the captain yells as he spins the *Island Hopper* around and motors toward the humpback mother and calf breaching 70 yards off our stern. But just as he executes this whiplash maneuver, a pair of false killer whales arcs gracefully out of the water off our port side, prompting another ear-splitting "Balleena! Balleena! Balleena!" and a replay of the wrenching U-turn. Then, just for fun, a gang of spotted and spinner dolphins begins pirouetting in the hellacious wake we're kicking up. It's bedlam, it's "Cetaceans Gone Wild," and in the midst of it all, Iliana Esquivel, our divemaster, tears off her wetsuit and grabs a mask and snorkel. "Look!" she squeals. One of the false killer whales, an 18-footer, has moseyed up alongside the boat and is lingering there, just beneath the surface, as though waiting for a salsa partner. Iliana, more than happy to oblige, quickly slips into the water and disappears.

I'm still not sure where the whales came from, but I can confirm that the Osa Peninsula is Costa Rica's wildest, most pristine region, a factor no doubt bearing on all this uninhabited frolicking. The Osa, a boot-shaped spur of mountainous jungle jutting into the ocean not far from the border with Panama, contains the last stand of virgin rain forest on Central America's Pacific coast, much of it protected within the 104,000-acre Corcovado National Park, the

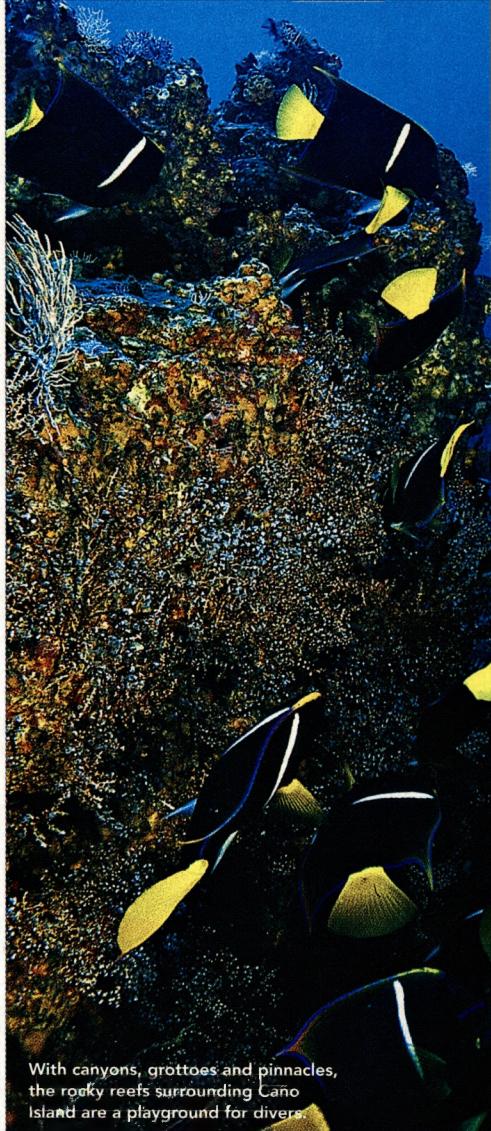
jewel of Costa Rica's acclaimed park system. Save for one modest tourist town on Osa's gulf side, Puerto Jimenez, the peninsula remains basically undeveloped and a monster to access overland. There are no paved roads, nor beachfront hotels here. There's not even electricity. A handful of generator-powered lodges sprinkled about the jungle hosts a trickle of divers and assorted nature lovers at any given time. But that's it. What all this means, basically, is that critters here continue to do as they please, and you don't have to work hard to spot them. The Osa pulsates with life, mostly because there aren't enough humans to muck things up.

Yet.

Which brings us to the cell tower. I notice it as we putter back from the dive, all cables and steel, poking high above the emerald jungle canopy near the village of Agujitas. It is the one thing in this wilderness not like the others, and it would appear to symbolize ... something. Exactly what though, no one around here seems certain of.

Long, Strange Trip

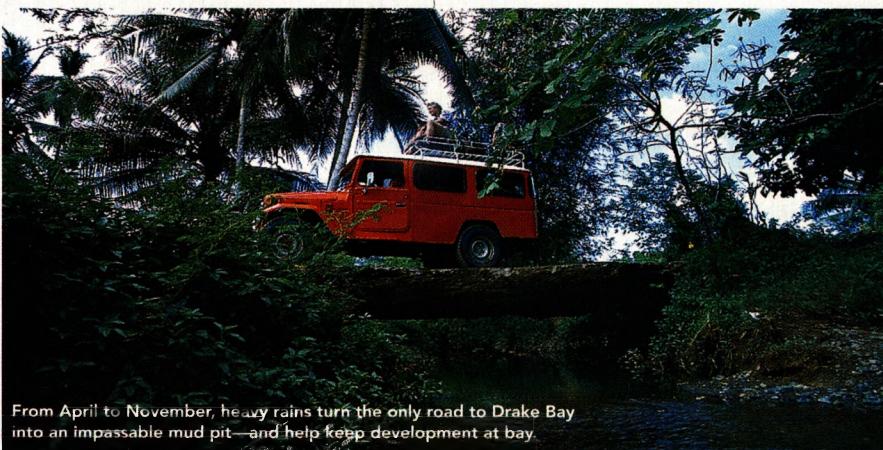
THE CELL TOWER isn't the only head-turning change on the peninsula. I'd come here to dive once before, in 1996, and back then, getting to Osa was a marathon event, a rite of passage packed with drama and suspense, like something out of *The African Queen*. I'd taken a 12-seater plane from San Jose to the tin-shack "airport" in Palmar Sur,



With canyons, grottoes and pinnacles, the rocky reefs surrounding Cano Island are a playground for divers.

trundled through a banana plantation in a wheezing VW cab, and snaked down the Sierpe River in a 16-foot skiff past yawning crocodiles and screaming howler monkeys. Spit out finally into the heaving swells of the Pacific, the skiff transported me across Drake Bay to my lodge, the Aguila de Osa Inn.

This time, I fly straight into Drake Bay, thanks to a 500-foot, red clay scar in the rain forest where someone has clear-cut an airstrip. The journey lacks the romance of my first trip, which is something Bradd Johnson, owner of Aguila de Osa, grumbles about upon my arrival. "I didn't want that airstrip," he insists. "I argued against it, but I lost that one."



From April to November, heavy rains turn the only road to Drake Bay into an impassable mud pit—and help keep development at bay.



I find Johnson just as I'd left him eight years earlier—lounging in his rocker, cocktail in one hand, plate of fresh fruit in the other and a sweeping view of Drake Bay before him. A lanky old salt from Rhode Island who made a killing in real estate, the guy dropped out of the rat race in 1991, plunked down in the rain forest and carved out the kind of exquisite, ecologically balanced lodge Costa Rica is famous for.

But now Johnson is tearing his hair out. The Osa, he explains, this Garden of Eden where animals run free, finds itself at a critical crossroads. All along the Pacific coast, the Cancun model of resort development is steamrolling the small-scale, tree-hugging

ELSEWHERE ON OSA

UNLIKE BAJO DEL DIABLO and El Barco, Caño Island's other two popular meeting spots for whitetips and mobulas deliver on their names. **Cueva del Tiburon (Shark Cave)** features a seven-foot-high, 40-foot-long cavern that also provides shelter to diamond stingrays and boxfish. **Los Arcos (The Arches)** has a collection of arching volcanic swim-throughs buzzing with colorful tropicals. Caño's fifth primary dive site, **Paraiso (Paradise)**, consists of five rocky mounds frequented by thick schools of horse-eye jacks, blue-striped snappers and barracuda.

approach that once earned Costa Rica its reputation as the cradle of ecotourism. Osa is one of the last holdouts. Its future largely depends on the village of Agujitas, the last town in Costa Rica without electricity. Politicians have promised the 250 families that power will come soon, a move that could trigger more development. Tourism officials recently released a study recommending that, when electricity comes, Osa increase its number of rooms for tourists from 142 to more than 700. "The people in the village should have electricity because they deserve it," says Johnson. "But there's a sustainable way to develop."

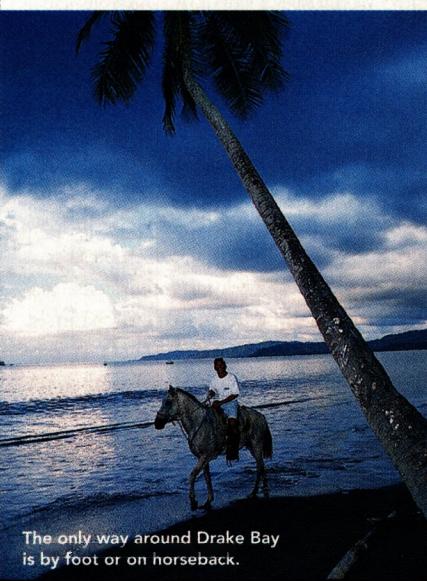
What will happen here? Johnson refuses to make predictions. But he does let me in on another change: "The mobula rays are gone." It's like a sucker punch to the stomach. The mobulas are the reason I've returned. Eight years earlier, I experienced one of my all-time perfect dive moments when I looked up from 50 feet down at Bajo del Diablo and watched a huge flock of rays soaring near the surface, 30 to 40 of them perfectly backlit by the sun. "El Niño, 2001," explains Johnson. "Ran 'em off, the big groups, anyway."

Riding the Caño Carousel

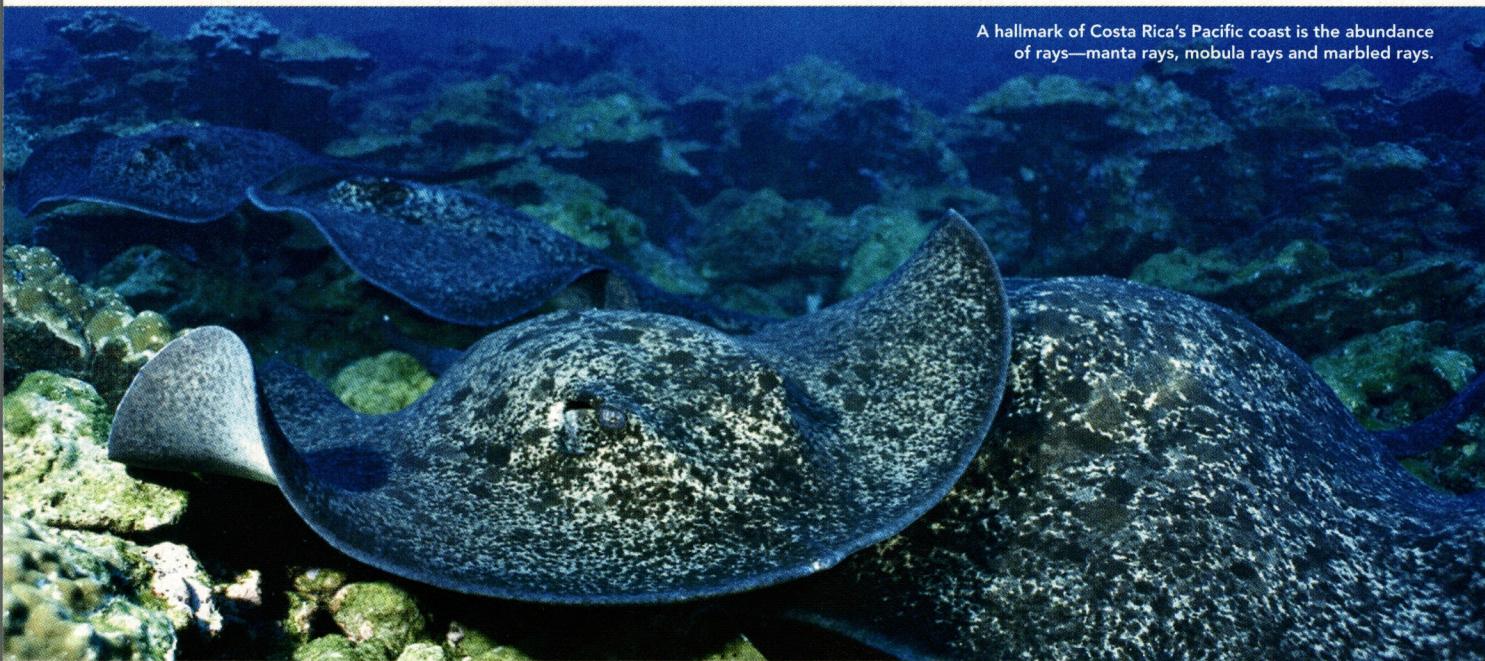
WE CREEP OVER a volcanic ridge and spy the neighborhood heavies below, whitetip reef sharks, a half-dozen of them, patrolling the sandy bottom and keeping the locals in line. We're 60 feet down, exploring a site called El Barco, "The

Boat," a curious name, since there's no wreck amid this patchy sprawl of boulders, just a lineup of tough guys. The green morays are especially quick to flash their bridgework when we edge close to their dens in the coral. Ditto the zebra eels. On our safety stop, a tornado of hefty barracudas swirls around us, hundreds of them, all canines and cuspids.

Surfacing, we find our bearings by locating Caño Island, the focal point for divers coming to Osa. This dreamy dollop of jungle and sand 11 miles west of the peninsula attracts a profusion of marine life, including monster schools of fish, patrolling sharks and rays, eels and the resident rock stars—pilot whales, false killer whales and five species of dolphin. Caño is also the world's only calving ground for two different migrations of humpbacks.



The only way around Drake Bay is by foot or on horseback.



A hallmark of Costa Rica's Pacific coast is the abundance of rays—manta rays, mobula rays and marbled rays.

After El Barco, we putter out to Bajo del Diablo, "Depth of the Devil," Caño's premier site. With a pair of towering, 150-foot pinnacles and a canyon in between, as well as intricate mazes of peaks and valleys to the east, west and south, Diablo is actually four or five sites in one.

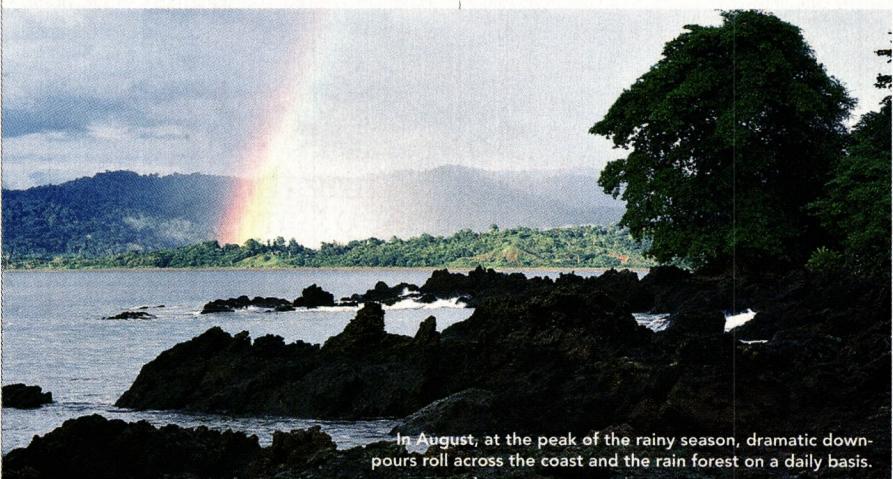
We plunk down 70 feet into the canyon, and, almost immediately, a powerful current launches us on something resembling a drift dive. A blur of color sweeps by my mask: Yellow and blue cup corals, green and pink sea fans and cottony-white gorgonians, all of it splashed across rocks, walls, ledges and cliffs. We fly over a riot of reef-hugging creatures, yellowtail damsels and rainbow wrasses, barberfish, hawkfish, flag groupers and king angels. A sudden thermocline reduces the 79-degree water seven or eight clicks. We round a corner, and finally, the current wanes. I slow down, get oriented. We then rise slowly through the water column, past swarming schools of Pacific creoles, past two- and three-foot-long amberjacks, real fatties, lumbering through side channels. Atop the column, a wild, silvery twister descends on us, a force much larger than the barracuda whirlwind at El Barco. Hundreds of big-eye jacks, maybe thousands, swoosh round and round us, faster and faster, like a carnival ride gone berserk. We can't get off.

Jungle Pigs

"BE VERY QUIET," Gustavo whispers. "Don't move." It's a strange request. We're deep inside Corcovado National Park, and I'm concentrating on a white hawk through the scope the biologist has set up for me. But when I glance up from the scope, I see what has my guide concerned. There, on the trail 20 feet before us, stands a pack of wild tusked pigs, white-lipped peccaries to be precise, two dozen of them, snouts high in the air and sniffing frantically. Fortunately, we're downwind of the beasts, but they suspect something, and they register anxiety by slamming their jaws together—*chomp! chomp!*—an unnerving sound, to say the least. "Stand completely still," urges Gustavo.

We'd been slogging through the mud since early this morning, and the jungle wasn't giving us much love. Already, a bunch of spider monkeys had pelted us with avocados, a gang of howler monkeys had realigned our boxers with a murderous shriek, and, most ignominious, a troop of capuchin monkeys had tried to piss on us from 60 feet up. As for the hairy black pigs that now want us dead, Gustavo and I had been tracking them for about two hours. Rather, we'd been tracking the jaguar that had been tracking the pigs. The story kept repeating itself in the fresh mud—a flurry of cloven hoofprints followed by the large outline of a feline paw.

As we followed the tracks beneath the



In August, at the peak of the rainy season, dramatic downpours roll across the coast and the rain forest on a daily basis.

WALT STEARNS (TOP); BRADLEYIRELAND.COM (BOTTOM)

sun-blocking canopy of towering trees, my biologist guide often stopped at the faintest twig snap. Then he'd set up the scope and have me peer through it: A shaggy three-toed sloth, dangling from a secopia tree. A squirrel-like agouti, rummaging about the undergrowth. A spectacled owl, surveying the forest floor from on high. Other denizens didn't require the scope: Iridescent blue morpho butterflies fluttering before our faces, and white-nosed coatis, cousins of the raccoon, crunching nuts in an almond tree just above our heads.

Now, after posing like statues for three minutes, the peccaries finally bolt off the trail and cut a wide swath around us. I curse. Gustavo doesn't. "It is the jungle," he proclaims, completely unfazed.

A Blessing of Mud

IT'S AUGUST, middle of the wet season, and there are two particularly satisfying results of the torrential downpours that roll through every night—the drama and the muck. The drama takes form in the pounding rain on my cabin's tin roof, along with lodge-rattling peals of thunder that ricochet between massive, old-growth trees. The muck shuts down the dirt road from Rincon to Agujitas from April to November. It's the only road connecting Drake Bay to the outside world, and it's used mostly by illegal loggers. The Osa refuses to be tamed easily.

"You couldn't have a better place as an example of ecotourism," Johnson argues over coffee on my final day. "There's nothing here. You're starting from scratch. They could make this place a model of how to develop wisely."

Johnson, other lodge owners, environmentalists and residents of Agujitas are certainly pushing for that. They're improving



Jungle color: A beetle on a blossom.

the water system in the village and planning a municipal dump. They're raising money to offset the cost of having electricity cabled underground to Agujitas rather than transmitted over wires, which is cheaper but requires clearing trees. There are other hopeful signs as well. The Corcovado

Foundation, a nonprofit Johnson works with, is buying up land in the critical buffer zone outside the national park and hiring guards to monitor for poaching and illegal logging.

Johnson is wrong about one aspect of

his assessment, however. It's something I don't realize until my final dive, on the south side of Bajo del Diablo. Ilana and I wind through deep, meandering trenches formed by volcanic walls, swimming through busy schools of yellow snapper and steel pompano. We're about to go stalking more whitetips when a pang of nostalgia suddenly strikes. I roll over, peer up at the surface and see the mobula rays. There are 40 of them at least, flying in formation, sunshine streaming down through the group. It's not a mirage. It'll take more than El Niño to scare these creatures away. **SD**

GET THERE To find out more about the Osa Peninsula, turn to In Depth, page 105, section 4.

BEYOND OSA

LIKE CAÑO, OTHER UNINHABITED ISLANDS off Costa Rica's Pacific coast serve as busy pelagic way-stations. In the north, 10-foot bull sharks prowl the volcanic pinnacles and arches of the **Bat Islands** in the Gulf of Papagayo, not far from the border with Nicaragua. In the same gulf but two hours south, the **Catalina Islands** lure mantas, whitetips and nurse sharks. Check out both spots during the rainy season (May to September) when visibility improves (50 to 60 feet) and the blustery Papagayo winds die down, making island access easier.

The mother of all uninhabited Costa Rican islands, however, is **Cocos Island**, arguably the greatest big animal dive spot on the planet. The submerged volcanic canyons, cliffs and spires here form a playground for hammerheads schooling in the hundreds, soaring eagle rays and trolling whale sharks. Cocos sits alone in the open Pacific 300 miles west of Osa, and accessibility is limited to three live-aboards: the *Sea Hunter*, the *Undersea Hunter* (www.underseahunter.com) and the *Oceanos Aggressor* (www.aggressor.com). Contact Costa Rica Dive, www.costaricadive.com, to arrange trips to any or all of these islands.



Accessible only by live-aboard, Cocos Island is one of the world's top big-animal encounters.

Grading the Live-Aboards

Our readers provide the lowdown on 10 dive vessels you can sleep on.

YOU'VE PROBABLY HEARD the popular live-aboard mantra that includes a whole lot of eating, sleeping and diving. It's cliché but true—there's a sublime pleasure in the redundant nature of a typical day aboard a cruising dive vessel. If you're looking for a dive vacation that maximizes your bottom time, minimizes the hassle and turns your fingers to prunes the quickest, nothing beats a live-aboard. But according to our readers, some boats are better than others. From the Gulf of Mexico to the Great Barrier Reef, here's the lowdown on 10 live-aboard dive vessels.

LIVE-ABOARDS

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TEL: (800) 327-9600, (305) 888-1226

WEB: www.blackbeard-cruises.com

CRUISE AREA: Bimini, Berry Islands and Grand Bahama area.

87 PERCENT OF RESPONDENTS said they would dive with this live-aboard again.

READERS SAY: J.K., Alexandria, Minn.: "The crew were very aware of the passengers' comfort and general happiness on board. They made us feel very at home in an unusual environment. They tried to accommodate our dive requests whenever possible. Very professional staff." Feb. '03. K.P., Knoxville, Tenn.: "Diving was great. Food was great ... Living conditions were rough, but it's a sailboat." March '03.

FEATURES: Camera rinse tanks; specialty certifications; universal referral; intro to scuba programs; gear storage; unguided diving; and solo diving.

BEST PACKAGE: Seven-day, six-night cruise for November through Feb. 14, 2004; \$100

off; excluding major holidays.

(SCORES)

Overall B. Staff A.

Boat/Facilities C-.

Food A-. Value B+.

EASTERN CARIBBEAN

Explorer Ventures, Caribbean Explorer II

TEL: (800) 322-3577, (903) 887-8521

WEB: www.explorerventures.com

CRUISE AREA: St. Maarten, Saba, Statia and St. Kitts.

83.3 PERCENT OF RESPONDENTS said they would dive with this live-aboard again.

READERS SAY: A.H., Durham, N.C.: "I liked the dive sites, the crew was great, the food was great and going ashore was a nice little plus." Aug. '03. D.R., White River Jct., Vt.: "They are willing to do a trip even if only a few divers are on board ... They have a fully air-conditioned dining room." June '03.

FEATURES: Nitrox; E-6 processing; camera rinse tanks; snorkel trips; specialty certifications; universal referral; camera, digital and video rentals; gear storage; retail and repair facilities; handicapped-accessible; and unguided diving.

repair facilities; and unguided diving.

BEST PACKAGE: Week-long packages with private bathrooms, dbl. occ., starting at \$1,145 p.p.

(SCORES)

Overall A+. Staff A+.

Boat/Facilities A.

Food A+. Value A+.

AUSTRALIA

Explorer Ventures, Nimrod Explorer

TEL: (800) 322-3577, (903) 887-8521

WEB: www.explorerventures.com

CRUISE AREA: Great Barrier Reef and Coral Sea, Cairns to Cooktown.

91.4 PERCENT OF RESPONDENTS said they would dive with this live-aboard again.

READERS SAY: M.R., Honolulu, Hawaii: "Very friendly staff. There was a great cook who catered to my vegetarian diet and we had a whale researcher onboard to give us lots of good information ... Fun atmosphere and comfortable accommodations ... They're definitely recommended." June '03. F.O., Sunnyvale, Calif.: "I liked the twin hull because it was stable. It seemed like there was plenty of space for everyone ... I didn't like that it was an older boat. The engine was noisy." April '03.

FEATURES: E-6 processing; camera rinse tanks; snorkel trips; specialty certifications; universal referral; camera, digital and video rentals; gear storage; retail and repair facilities; handicapped-accessible; and unguided diving.

BEST PACKAGE: Itineraries from four to 11 days, both dbl. and quad. occ., starting at \$595 p.p., quad. occ., for a four-day trip.

(SCORES)

Overall A-. Staff A+.

Boat/Facilities B+.

Food A-. Value A-.



AUSTRALIA

Mike Ball's Spoilsport**TEL:** (800) 952-4319, (011) 617-4053-0500**WEB:** www.mikeball.com**CRUISE AREA:** Outer edge of the Great Barrier Reef and the remote oceanic reefs of the Coral Sea.**95 PERCENT OF RESPONDENTS** said they would dive with this live-aboard again.**READERS SAY:** C.S., Amarillo, Texas: "I truly have no complaints. Every need and desire was seen to in a quick, professional manner and the diving was the best!" March '03. W.C., Vancouver, B.C.: "I don't have a bad word to say about the trip out on *Spoilsport*. The service was fantastic, the crew outstanding and the overall experience left me wanting more." April '03.**FEATURES:** Nitrox; E-6 processing; camera rinse tanks; snorkel trips; specialty certifications; universal referral; camera and video rentals; technical diving; intro to scuba programs; gear storage; retail and repair facilities; limited handicapped-accessible; unguided diving; and solo diving.**BEST PACKAGE:** Visit Scuba Zoo, where we feed up to 30 or more sharks, the Yonagala wreck and Flinders Reef in the Coral Sea. Offering seven nights with unlimited diving. Nitrox, E-6 processing and a free reef ecology program are all available on board. See web site for detailed itineraries.**(SCORES)**

Overall A. Staff A+.

Boat/Facilities A-.

Food A-. Value A-.

AUSTRALIA

Mike Ball's Supersport**TEL:** (800) 952-4319, (011) 617-4053-0500**WEB:** www.mikeball.com**CRUISE AREA:** Cod Hole and Ribbon Reefs.**86.4 PERCENT OF RESPONDENTS** said they would dive with this live-aboard again.**READERS SAY:** M.W., Allansford, Va.: "My

wife and I enjoyed the whole trip so much, we booked again for next year as soon as we got back to Cairns." June '03. S.H., Duluth, Minn.: "Relaxed, but very efficient attitude. The crew was very friendly. They ate with us and dove with us." July '03.

FEATURES: Nitrox; E-6 processing; camera rinse tanks; snorkel trips; specialty certifications; universal referral; camera and video rentals; technical diving; intro to scuba programs; gear storage; retail and repair facilities; limited handicapped-accessible; unguided diving; and solo diving.**BEST PACKAGE:** Offering three to four nights with up to 12 dives. Expeditions include a low-level flight over the Great Barrier Reef to Lizard Island, diving Cod Hole and the Ribbon Reefs. Nitrox, E-6 processing and a free reef ecology program are all available on board. For detailed itineraries, see our web site.**(SCORES)**

Overall A. Staff A+.

Boat/Facilities A.

Food A+. Value A+.

BAHAMAS

Nekton Diving Cruises, Nekton Pilot**TEL:** (800) 899-6753, (954) 463-9324**WEB:** www.nektoncruises.com**CRUISE AREA:** Belize (winter), Cay Sal Bank and Bahama Adventure.**76.2 PERCENT OF RESPONDENTS** said they would dive with this live-aboard again.**READERS SAY:** D.C., Davis, Calif.: "The crew worked really well together. It was the best trip we ever had because everything was planned out." March '03. K.W., Plain City, Ohio: "The boat cabins need fixing up. However, I would recommend the diving, crew and food." Feb. '03. B.H., Lahaina, Hawaii: "I liked the food and how they let you dive your own dive profiles." March '03**FEATURES:** Nitrox; E-6 processing; camera rinse tanks; snorkel trips; specialty certifications; universal referral; camera and video

rentals; intro to scuba; gear storage; retail and repair facilities; handicapped-accessible; unguided diving; and solo diving.

BEST PACKAGE: \$1,295 on selected sailings. Packages include accommodations, meals, diving, tanks and weights, and airport transfers.**(SCORES)**

Overall A. Staff A+.

Boat/Facilities A-.

Food A+. Value A+.

BAHAMAS

Paradise Charters, Easy Goin'**TEL:** (954) 524-8717**WEB:** www.paradisecharters.com**CRUISE AREA:** Bimini.**97.3 PERCENT OF RESPONDENTS** said they would dive with this live-aboard again.**READERS SAY:** A.G., Albuquerque, N.M.: "The crew was very fun, friendly and flexible about our diving requests. The home-cooked meals were great. I would definitely recommend them to others." July '03. L.B., Muncy, Pa.: "This was a 62-foot boat with a maximum of six divers ... The boat was spotless and everything was well-maintained ... The food was frequent, excellent and more than anyone could eat." July '03. A.B., Charleston, S.C.: "The divemaster was awesome—very knowledgeable about the sites, safety-conscious, considerate of others, and a wonderful dive instructor ... The vessel was clean, well-kept, roomy and comfortable ... The dives were well-planned and well-executed." July '03.**FEATURES:** Camera rinse tank; snorkel trips; specialty certifications; universal referrals; gear storage; rental and repair facilities; and unguided diving.**BEST PACKAGE:** Weeklong wild dolphin trip to Grand Bahama. Departs late Sunday night and returns early Saturday morning. Dive and swim with wild dolphins all day. Includes all meals, snacks, beverages, tanks and weights, \$1,500 p.p., dbl. occ.

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San Jose, CA Aqua Adventures Unlimited Burbank, CA Aquatic Center & DAD Newport Beach, CA Bamboo Reef San Francisco, CA Beach Cities Scuba Center Huntington Beach, CA Captain Aqua's Dive Center Dublin, CA Dive N Board Concord, CA Diver Dan's Wet Pleasure Santa Clara, CA Liburdis Scuba Center Costa Mesa, CA Mako Marine Napa, CA Ocean Enterprises San Diego, CA Open Water Habitat Santa Ana, CA Pacific Sporting Goods Long Beach, CA Peninsula Diving Center Mountain View, CA Reef Seekers Dive Co Beverly Hills, CA Rick's Diving Locker Escondido, CA Santa Barbara Aquatics Goleta, CA Scuba Schools of America Montclair, CA Scuba Schools Of America Woodland Hills, CA Scuba Schools of America Riverside, CA Scuba Toys Cypress, CA Ventura Dive & Sport Ventura, CA Wallin's Dive Center San Carlos, CA A-1 Scuba & Travel Center Englewood, CO	(256) 350-1122 (251) 342-2970 (256) 880-6307 (334) 774-3483 (205) 978-3386 (501) 225-3990 (501) 753-6004 (520) 888-7300 (480) 833-2971 (818) 700-8134 (310) 326-6663 (408) 244-4433 (818) 848-2163 (949) 650-5440 (415) 362-6694 (714) 378-2611 (925) 829-3843 (925) 689-6969 (408) 984-5819 (714) 662-7230 (707) 251-5600 (858) 565-6054 (714) 558-1055 (562) 434-1604 (650) 965-2241 (310) 652-4990 (760) 746-8980 (805) 967-4456 (909) 621-4171 (818) 225-1616 (909) 689-2422 (714) 527-0430 (805) 650-6500 (650) 591-5641 (303) 789-2450	Underwater Phantaseas (Englewood) Greenwood Village, CO Underwater Phantaseas (Lakewood) Lakewood, CO Action Aquatics Tampa, FL American Dive Center, Inc. Boca Raton, FL American Scuba Divers, Inc. Pompano Beach, FL Aquatic Adventures Zephyrhills, FL Blue Planet Dive & Surf Port St. Lucie, FL Brownie's Southport Divers Ft. Lauderdale, FL Conch Republic Divers Tavernier, FL Deep Six Divers Service Lakeland, FL Divers City USA, Inc. Tavernier, FL Eagle Ray Dive Center Bonita Springs, FL Emerald Coast Scuba Destin, FL Extasea Dive Center Orlando, FL Florida Frogman, Inc. Miami, FL Florida Scuba Connection, Inc. Winter Garden, FL Florida West Scuba Schools Venice, FL Fun 2 Dive, Inc. Sanford, FL Kissimmee Professional Dive Center Kissimmee, FL MBT Divers Pensacola, FL Orlando Scuba Center Casselberry, FL Our Ocean Dreams Clearwater, FL Scuba Florida Orange City, FL Scuba Tiger, LLC Orange Park, FL Scuba Works Jupiter, FL Scuba World, L.L.C. Orlando, FL Sea Hunt Scuba St. Augustine, FL Seafari Dive & Surf Jupiter, FL SeaPro Scuba Center Riviera Beach, FL Seminole Scuba, Inc. 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READER RATINGS

(SCORES)

Overall A+. Staff A+.
Boat/Facilities A+.
Food A+. Value A+.

FLOWER GARDEN BANKS, TEXAS

Gulf Diving, Fling

TEL: (979) 233-4445

WEB: www.gulf-diving.com

CRUISE AREA: Freeport, Texas, to the Flower Garden Banks and Stetson Bank.

88.2 PERCENT OF RESPONDENTS said they would dive with this live-aboard again.

READERS SAY: M.P., Vicksburg, Miss.: "The captains and crew were very much focused on safety and making this a good experience. They provided an excellent departure briefing as well as pre-dive briefings ... They provide two camera tanks and one large

camera table ... There are two well-designed boarding ladders for the return to the boat. Current lines with buoys, a tag line for each ladder and a long tag line from the stern of the boat for strong currents are also provided ... This is not a luxury cruise. But you are going for the diving, not the luxury staterooms." July '03. H.W., Austin, Texas: "The cook strove to meet the needs of every person on board. We had a vegetarian, someone on the low-carb Atkins Diet, and someone else on the low-fat/low-sugar diet." July '03.

FEATURES: Nitrox; camera rinse tanks; and unguided diving.

BEST PACKAGE: Check the web site for trip dates and store info.

(SCORES)

Overall A-. Staff A+.
Boat/Facilities B+.
Food A. Value A+.

FLOWER GARDEN BANKS, TEXAS

Gulf Diving, Spree

TEL: (979) 233-4445

WEB: www.gulf-diving.com

CRUISE AREA: Freeport, Texas, to the Flower Garden Banks and Stetson Bank.

94 PERCENT OF RESPONDENTS said they would dive with this live-aboard again.

READERS SAY: J.S., Laredo, Texas: "The captain and crew were the epitome of professionalism. The divemasters performed with unerring precision and paid extra attention to safety. The galley staff stuffed us silly with great food all day long. As usual, these boats continue to be the Cadillac of live-aboards for hard-core divers that really want to dive hard." Aug. '03. M.C., Denham Springs, La.: "I liked everything. However, only three heads for 40 people can be a little crowded with a full boat." Aug. '03.



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What the island has to offer



FEATURES: Nitrox; camera rinse tanks; and unguided diving.

BEST PACKAGE: Check the web site for trip dates and store info.

(SCORES)

Overall **A+**. Staff **A+**.

Boat/Facilities **A-**.

Food **A+**. Value **A+**.

MICRONESIA

Odyssey Adventures, Truk Odyssey

TEL: (800) 757-5396, (904) 346-3766

WEB: www.trukodyssey.com

CRUISE AREA: Truk Lagoon.

90.3 PERCENT OF RESPONDENTS said they would dive with this live-aboard again.

READERS SAY: E.Z., Villa Park, Ill.: "There was nothing we didn't like about the

Odyssey. We were treated royally from the amazing beginning to the glorious end. We explored phenomenal and massive World War II Japanese shipwrecks—havens for lush coral formations and enormous habitats for a wealth of marine life. Plus, I had a king-sized bed and delicious food. This was a dive vacation I will never forget!" July '03. C.K., Chicago, Ill.: "Our first charter on the Odyssey was so great, we booked our second trip before we departed. The boat is in excellent condition and the accommodations are extremely comfortable."

Needless to say, we're looking forward to planning our third trip!" July '03.

FEATURES: Nitrox; E-6 processing; camera rinse tanks; specialty certifications; camera, digital and video rentals; technical diving; gear storage; unguided diving; and solo diving.

BEST PACKAGE: Seven-nights, six days of diving, Sunday to Sunday cruises, \$2,395.

(SCORES)

Overall **A+**. Staff **A+**.

Boat/Facilities **A+**.

Food **A+**. Value **A+**.

SD

Note: Scores are based on a response of more than 6,000 surveys. Overall scores for live-aboards are derived by averaging their individual scores based on staff, boats, facilities, food and value. To ensure statistical validity, only those live-aboards that were rated by 25 or more readers are included here. Changes or improvements may have been made since information was gathered and may not be reflected in the scores.

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HOPKINS, BELIZE

Jaguar Reef Resort Opens Coco Plum Cay

1 THE DEAL: Jaguar Reef Resort has opened a new island facility called Coco Plum Cay, which serves as a base for watersports activities including scuba diving, snorkeling, fishing, kayaking and beachcombing. Guests have exclusive access to this private island and the barri-



er reef is just a few minutes away. The facility offers five beachfront cabanas, plus a spacious bar and restaurant, including air-conditioned indoor dining.

Rates for four days, three nights, two days of diving range from \$549-\$649; five days, four nights, three days of diving, \$749-\$879; six days, five nights, four days of diving, \$949-\$1,099; seven days, six

nights, five days of diving, \$1,149-\$1,299; and eight days, seven nights, six days of diving, \$1,249-\$1,499. The lower price is for stays through Dec. 15, 2003, the higher for stays Jan. 4-April 30, 2004. Package prices are based on double occupancy and include air-conditioned accommodations, all meals, round-trip transfers from Dangriga, taxes and service charges. Diving includes tanks and weights; dives can be exchanged for land or sea tours at no extra charge. Boat transfer from Coco Plum to Jaguar Reef Lodge on mainland six times daily. (800-289-5756 or 501-520-7040, www.cocoplumcay.com)

BRITISH VIRGIN ISLANDS

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2 THE DEAL: Save \$130 on one-week charters aboard the Juliet, a

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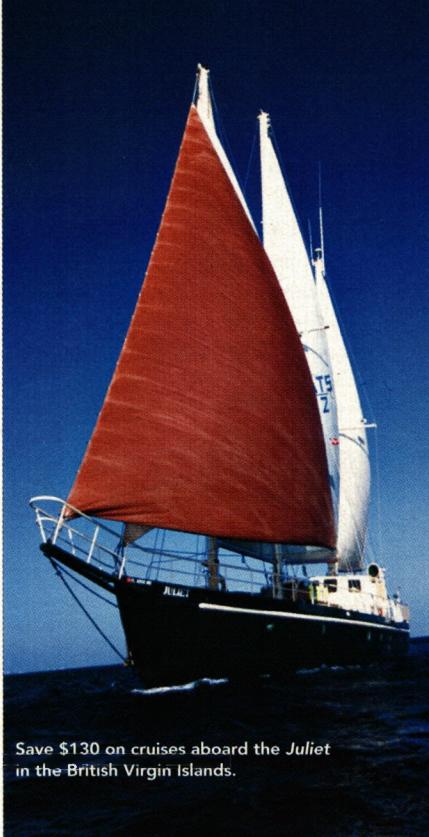
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fully appointed live-aboard dive boat featuring six staterooms, a crew of five and a limit of 12 guests per cruise. This 104-foot, three-masted schooner sails week-long itineraries in the British Virgin Islands. One week, all-inclusive, Jan. 3-23, 2004, \$1,160 p.p., dbl. occ. (866-5-JULIET, 650-321-6297, www.sailjuliet.com)

TURKS & CAICOS

Explorer Ventures Launches New Live-Aboard

3 THE DEAL: The newly remodeled 18-passenger Turks & Caicos Explorer, the most recent addition to the Explorer Ventures fleet, has begun service from Providenciales. The vessel's dive deck has been completely redesigned with easy-access stairs to the dive platform, new upper-deck staterooms with private facilities, indoor and open-air



Save \$130 on cruises aboard the Juliet in the British Virgin Islands.

salons, and nitrox capability.

Seven-day diving expeditions start at \$1,195 p.p., dbl. occ., for cabins with shared facilities during the low season, and range up to \$1,595 p.p. for double staterooms with private bathrooms during the high season. Repeat passengers can save 20 percent on the package price for each dive buddy they travel with who has never been on an Explorer Ventures boat. (800-322-3577, 903-887-8521, www.explorerventures.com)

BAY ISLANDS, BELIZE, CAYMAN ISLANDS AND TURKS & CAICOS

Aggressor Fleet's New Diver Discount

4 THE DEAL: New divers get a \$200 discount off Aggressor live-aboard charters in the Bay Islands, Belize, Cayman Islands and the Turks &

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DIVE DEALS

Caicos in January and February, and September and October 2004. To receive the discount, divers must show open-water C-cards verifying certification within 12 months of the travel date. Some restrictions may apply; offer is noncommissionable. (800-348-2628, www.aggressor.com)

COZUMEL

Brisas Hotel's All-Inclusive Package

5 THE DEAL: Seven nights' all-inclusive accommodations, five days of two-tank morning boat diving, one welcome tank for shore diving, transfers between the airport and hotel, half-hour

massage, \$805 p.p., dbl. occ. Valid through January 2004 (not including Dec. 24-Jan. 2). Group special available, one free for 14 paying divers. (877-454-4355, www.brisashotel.com)

PUERTO RICO

Copamarina Beach Resort Fall Special

6 THE DEAL: Seven nights in garden-view accommodations, six days of two-tank morning boat dives, taxes, tanks and weights, \$893 p.p., dbl. occ. Valid through Dec. 21. Call for discounted airfares. (Caradonna Caribbean Tours, 800-328-2288, 407-774-9000, www.caradonna.com)

GRAND CAYMAN

Ocean Frontiers Winter Break Dive Packages

7 THE DEAL: Ocean Frontiers, The Reef Resort and Avis are teaming up to offer Winter Break Dive Packages. Three nights, two days of diving is \$485 p.p.; four nights, three days of diving, \$665 p.p.; five nights, four days of diving, \$855 p.p.; six nights, five days diving, \$1,040 p.p.; seven nights, six days diving, \$1,155 p.p. These packages include tax and a car rental for the entire stay. Valid Jan. 4-April 16, 2004, and subject to availability. Rates are based on double occupancy in a beachfront studio. Additional nights and dive rates available. (Ocean Frontiers, 888-232-0541 or 345-947-0000, www.oceanfrontiers.com)

LITTLE CAYMAN & CAYMAN BRAC

Reef Fanta-Seas Fall and Winter Specials

8 THE DEAL: Reef Fanta-Seas is offering Fall and Winter Specials in the Sister Islands. Seven nights' pool-view accommodations at the Little Cayman Beach Resort and six days of two-tank morning boat diving is \$1,169 p.p., dbl. occ. Seven nights' deluxe

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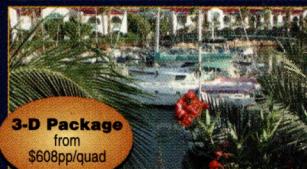
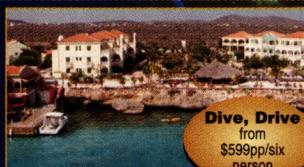
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9 THE DEAL: Accommodations at Playa Azul Hotel now also include greens fees, a \$150 value. Dive in the morning with Dive Cozumel and play golf in the afternoon, or vice versa. Six nights' accommodations, five days of two-tank diving, \$740 p.p., dbl. occ.; five nights' accommodations, three days of two-tank diving, \$545 p.p., dbl. occ. All packages include welcome dive and tank. Prices do not include occupancy tax of 12 percent. (*www.divecozumel.net, www.playaazul.com*)

PUERTO VALLARTA

Vallarta Adventures' All-Inclusive Package

10 THE DEAL: Vallarta Adventures is offering a six-day, all-inclusive dive package in Nuevo Vallarta, including five nights' accommodations at Hotel Marival and 11 dives for \$595 p.p., dbl. occ. Valid through 2005. (*866-256-2739, www.vallarta-adventures.com*)

PAPUA NEW GUINEA

AUD\$500 off Paradise Sport Cruises

11 THE DEAL: Mike Ball Dive Expeditions is offering AUD\$500 (500 Australian dollars) off any berth aboard its *Paradise Sport* live-aboard cruises in Papua New Guinea through January 2004. Call or e-mail for reservations, more information and currency conversion rates. (*888-MIKE-BALL, resv@mikeball.com, www.mikeball.com*)

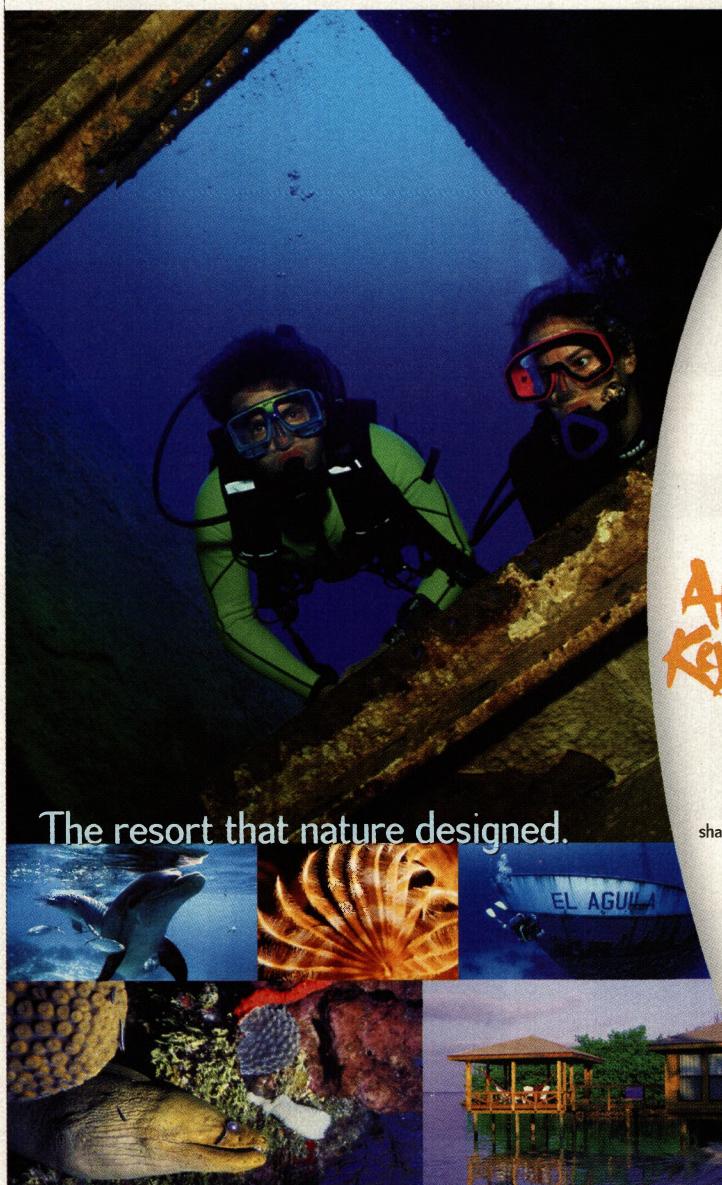
GRAND CAYMAN

Cobalt Coast & Divetech "Suite" Dive 'N' Drive Deal

12 THE DEAL: Cobalt Coast and Divetech announce their "Suite" Dive 'N' Drive Deal. From Jan. 3-24, 2004, book a dive and room package and get \$379 off per person. Five-night packages

include accommodations, tax and service charge, daily breakfast, rental car, daily two-tank boat dive, free upgrade to a one-bedroom garden or ocean suite, unlimited shore diving and scooter rental for \$897 p.p., dbl. occ. Other options are available. (*866-622-9626, www.cobalt-coast.com or www.divetech.com*)

SD



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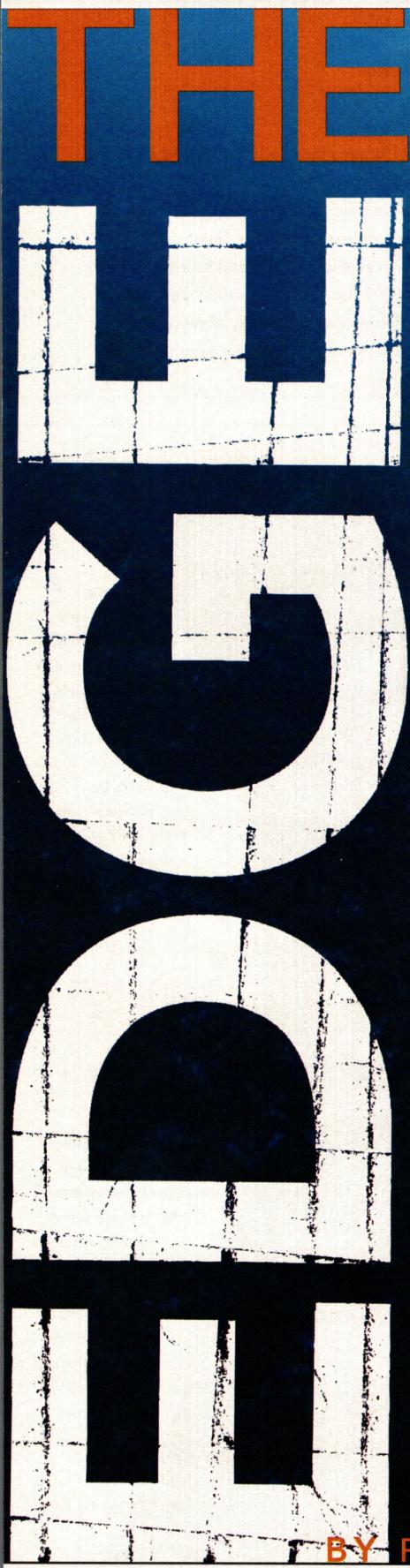
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THE HOTTEST,
COLDEST, LONGEST,
DEEPEST AND HIGHEST
DIVES IN THE WORLD.



BY PAUL KVINTA



Playing with fire: The spectacular collision of molten lava and seawater can produce unpredictable explosions of rock and scalding steam.

AS A SPORT, scuba diving doesn't bother with the trivial accumulation of points or the impressing of judges. Ours is an inherently barrier-smashing pursuit of pure exploration, one that transports the practitioner beyond the sport itself and thrusts him into whole new universes. Scientists dive to study the feeding habits of great whites. Archaeologists dive to uncover lost civilizations. With little more than technology and our own imaginations holding us back, what are the limits?

Where is the edge?

The places featured in this article constitute the extreme boundaries of diving. They are the hottest, the coldest, the highest, the longest and the deepest. These are not, however, merely stories of place, but also of the pioneers who boldly charted those places. Whether it was Johan Reinhard dragging his tanks up one of the world's tallest volcanoes, or Sam Meacham pressing into the forbidden netherworld of the planet's deepest cave system, these folks pushed scuba to the next level. Of course, most divers will never get anywhere near Licancabur or Ox Bel Ha, and that's understandable. But that doesn't mean you'll never dive at altitude or explore a cave someday. Read these tales for inspiration. Then, turn to "In Depth" on page 105 where we'll point you in a direction that helps you define your own personal edge.

THE Kilauea

"I'VE SEEN FISH SWIMMING AROUND with burns on them," claims lava diver Bill DeRoy. "Really, you see them." Well, you see them when you dive where 2,000-degree molten lava rushes into the ocean, as DeRoy occasionally does in the shadow of the world's most active volcano, Kilauea, off the southeast coast of Hawaii's Big Island. This angry, 4,000-foot mountain has been spewing magma every day since 1983, and when the glowing liquid oozes down Kilauea's Eastern Rift Zone to the shoreline and makes contact with those huge Pacific swells, divers who dare to plunge here witness all hell breaking loose. Literally.

When lava mixes with seawater, spectacular events unfold, all of them extremely hot, all of them extremely dangerous. At the surface, lava instantly transforms water into steam, causing dramatic explosions and launching rocks, molten fragments and scalding water 40 feet into the air. Beneath the surface, lava-filled boulders can explode, sometimes shooting flames through the water, while others implode, causing concussive, body-throttling booms! Boiling pools of water rise and settle at the surface, and, with all this activity, great visibility often disappears without warning. "Lava is moving at you from every direction," says DeRoy, who has worked as a safety diver with videographers shooting this mayhem. "Boulders the size of La-Z-Boys are falling down all around you. Anyone shooting footage needs a safety diver almost attached to him, ready to move him in a split second."

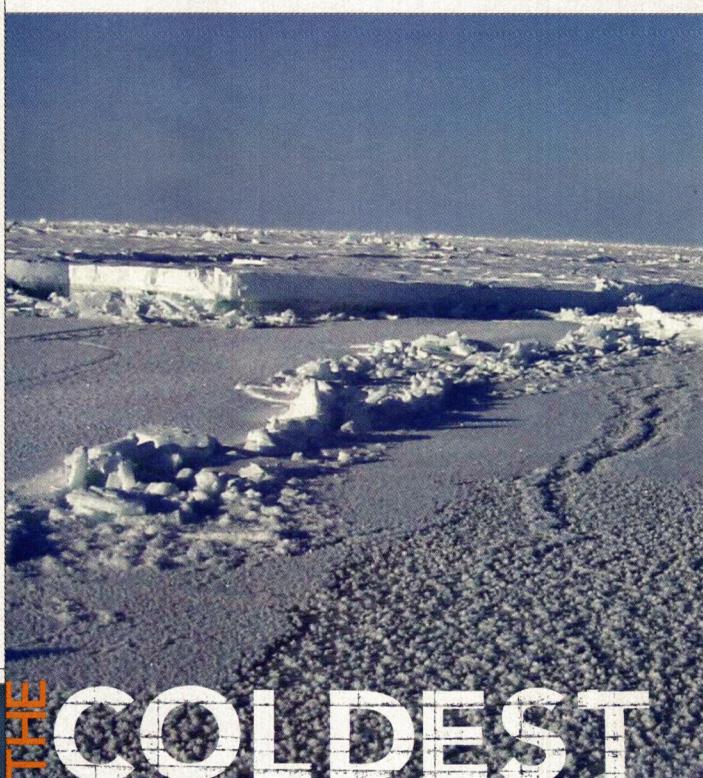
In 1971, underwater cameraman Lee Tepley and volcanologist James Moore made the first-ever lava dive to investigate one of the many flows produced by Kilauea since the 1950s. Tepley's award-winning footage featured "pillow lava," long tubes of brilliant red magma that snake through the water before hardening, turning black and then bursting open again to birth new tubes. Since then, about 100 scientists, docu-

LAVA IS MOVING
AT YOU FROM
EVERY DIRECTION.
BOULDERS THE SIZE
OF LA-Z-BOYS ARE
FALLING DOWN ALL
AROUND YOU.



mentarians and adrenaline junkies have dived with lava off Kilauea, the only place in the world where this particular brand of fate tempting takes place. So far, no one has died doing this, but there have been close calls, especially involving underwater landslides. When enough volcanic rubble collects along the steep submerged slope where lava enters the ocean, the shaky pile can instantly give way, as it did in 1987 with DeRoy's team filming at 50 feet. "There was an increase in implosions and these firecracker sounds, and we all looked up at the same time and saw it coming," he recalls. "Our visibility disappeared in seconds." Suddenly in the dark, the team clutched together as debris tossed, twirled and dragged them down the slope. When everything finally settled down, they found themselves at 150 feet. A few days later, another landslide hauled Tepley down to 300 feet. He swore off lava diving forever.

Given current instability at the site, DeRoy and most others haven't dived there in about a year, but conditions could change overnight; such is the unpredictability of Kilauea. "No one tells Madame Pele what to do," DeRoy warns, referring to the revered Hawaiian volcano goddess. "She is very, very powerful."



THE COLDEST

The North Pole

THERE'S NOTHING JOLLY OR ELFISH about Santa's backyard. Ask Bob Wass. When he led the first successful dive expedition at the geographic North Pole in 1999, two of his team's cold-water regulators froze up, a weight belt cracked and popped off one diver, and another's fins crumbled upon exiting the 28-degree water for a topside temperature of 40 below zero. And these were

just niggling concerns compared with the big picture. "You're on floating ice on the ocean," says Wass, a native Long Islander. "The ice can crack beneath you without warning. Your dive hole can close or freeze over pretty quickly. Anything can happen."

Think of the North Pole as a giant, rumbling motel ice machine. Unlike Antarctica, a solid landmass, the 1,200-mile-wide ice sheet that blankets the top of the earth is forever shattering and reforming, with drifting slabs of frozen tonnage constantly slamming into one another, grinding, cracking, uplifting and shaping whole new landscapes. Sometimes the pole sits exposed in the open Arctic Ocean. Other times, it's covered by 40 feet of ice. The only thing certain about diving this forbidden icescape is when to do it, and that's April, when the ferocious winds and storms that rage here for 11 months abate somewhat, offering a brief window for intrepid souls to don insulated underwear and dry suits and slip beneath the ice.

The first attempt to dive the pole in 1998 ended in disaster when Andrei Rozhkov, leader of a Russian team, inexplicably went limp and died minutes into a solo dive. His teammates had to sit with his body for three days after an ice storm prevented helicopters from

The polar ice sheet floats on the Arctic Ocean, with massive slabs of ice rumbling and colliding, opening rifts and cracks that can swallow a dive expedition.



rescuing them. Team members later said they'd seen mysterious spotlights and heard a deafening "sonar ping" right before Rozhkov's death, prompting speculation that a patrolling Russian submarine may have caused his demise. One year later, fortunately, Wass's nine-man international team experienced no such Clancy-esque episode. The men choppered in from a Russian-operated "ice airport" 60 miles from the pole and set up a toasty staging tent next to an open "lead" between two ice plates. They filled their tanks on-site, as the

(ABOVE & TOP RIGHT)



In 28-degree water and sub-zero surface temps, regulators freeze, fins crumble and weight belts crack.

humidity in pre-filled tanks would have frozen instantly. Then they plunked into the water and found a world both eerie and dazzling. Beyond a few translucent shrimp and jellyfish, the place was virtually lifeless and still, with the seafloor some two-and-a-half shadowy miles beneath them. But when they gazed up at the surface they saw what appeared to be a ceiling full of chandeliers. Says Wass: "There were these beams of turquoise light, refracting through all that broken ice. It was spectacular."

Since then, a handful of tourists and scientists have dived the pole, including Paul Aguilar, who each April burns a hole through the ice to retrieve a mooring lined with dozens of sensing devices for the National Science Foundation's North Pole Environmental Observatory program. "Sure, it's cold," says Aguilar. "But it's possible to over-prepare. Last time, if you can believe this, I was way too warm. Next year, I'm wearing less fleece under my dry suit."

THE HIGHEST ICE



Going up: When Johan Reinhard first dived the lake on top of Licancabur, altitude tables were no help. They stopped at 14,000 feet. The mountain peaks at 19,200.

Licancabur

STRICTLY SPEAKING, AS A BODY OF WATER, the crater lake atop Licancabur volcano in Chile possesses all the scuba excitement of a YMCA lap pool. The lake's surface area isn't much bigger than that, its depth reaches a meager 20 feet, and unless you're a fan of zooplankton, there are no gape-worthy critters finning about in there. Still, it's hard to ignore the one damn-impressive feature about this place—Licancabur's water-filled crater sits high above the clouds at 19,200 feet, making it the loftiest dive site on record.

It earned that status in the early 1980s when Johan Reinhard, an explorer in residence for the National Geographic Society and a real-life Indiana Jones, scaled the volcano in his ongoing search for high-altitude Inca sacred sites. The mountain-climbing, scuba-diving archaeologist—noted particularly for his 1995 discovery at 20,000-plus feet of an Inca mummy dubbed the "Inca Ice Maiden"—had read about ruins along the rim of Licancabur, and he'd heard murmurings about something even more enticing. "There was this legend about a gold statue in the lake," he says, explaining that the Incas often made offerings into Andean lakes to appease various gods.

In April 1980, Reinhard summited the snow-covered mountain and saw the frozen lake for the first time. He returned during the summer in 1981 and made several free dives in the 40-degree water, although the oxygen-deprived mountain air made reaching the shallowish bottom a Herculean task, even for Reinhard, who free-dives to 50 feet in the ocean. Nevertheless, the lung-burning plunges

revealed brilliant clouds of red, yellow and brown zooplankton, a discovery that, along with the possibility of cultural artifacts, prompted Reinhard and four others to plot a return a year later with scuba gear and cameras.

Beginning at 4,900 feet, the team made three grueling trips up Licancabur's steep, rocky slopes, schlepping dry suits, regulators, lead weights and a rubber dinghy. They also hauled tanks of pure oxygen, as Reinhard figured they could enjoy the benefits the gas provided at altitude without running the risk of toxicity, given the shallow depth of the lake. Dive tables at the time provided bottom times only for dives up to 14,000 feet of altitude, so the team extrapolated the numbers to 19,200. Over four days, they made 11 dives,

"**THERE WAS THIS LEGEND ABOUT A GOLD STATUE IN THE LAKE." THE INCAS OFTEN MADE OFFERINGS INTO ANDEAN LAKES TO APPEASE VARIOUS GODS.**



JOHAN REINHARD (ABOVE & LEFT)

methodically scouring the lake bottom with a metal detector. Alas, unlike his many gold and silver discoveries in other high Andean lakes, Reinhard found no submerged artifacts. Still, like any discovery-bound scientist, he did find satisfaction in one important, if obscure, find—a new species of zooplankton, carefully collected, sealed in formaldehyde and shuttled down the mountain.

Reinhard insists he climbs and dives only in pursuit of science, and while he reckons he'll dive Licancabur again to continue his research, he doesn't see himself diving above that. "I don't know of a higher body of water," he says, "let alone one with Inca ruins near it."

When Phillips and Meacham first strapped on tanks and dropped into a *cenote*, or sinkhole, deep in the jungle in 1998, they were hopeful. The Yucatan's porous limestone is pocked with more than 3,000 cenotes, many leading to subterranean complexes, and by 1998 other teams had already explored two vast systems nearby, Nohoch Nah Chich and Dos Ojos. At the bottom of Cenote Esmeralda, Phillips and Meacham discovered something tantalizing—a giant, fossil-littered thoroughfare they later named "The Mayan Skyway," 100 feet wide and 30 feet tall, with side passages branching off everywhere. Subsequently, over the course of several expeditions, the team pushed

Cenote Odyssey is just one access point to the 66 mapped miles of Ox Bel Ha, the world's longest flooded cave.



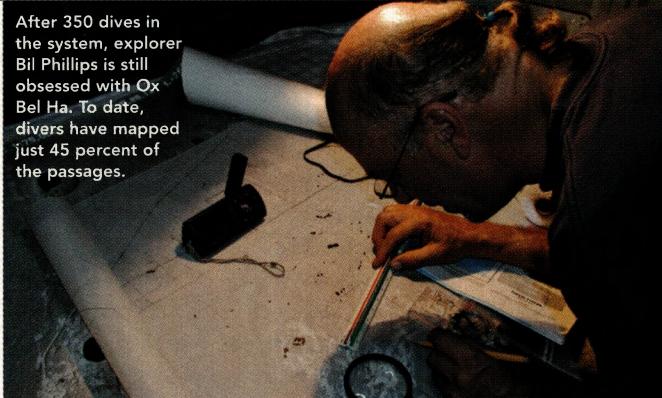
"WE STARTED DOING THIS FOR THE THRILL OF EXPLORATION," SAYS MEACHAM. "BUT NOW THERE'S A DIFFERENT CHALLENGE, AND IT'S HARD, TRYING TO PRESERVE SOMETHING THAT PEOPLE CAN'T SEE."

Ox Bel Ha

ON A MAP, THE FLOODED TUNNELS of Ox Bel Ha (*ohsh-bel-ha*) bear a frightening resemblance to Medusa's frenzied do-passages snaking wildly in all directions, looping, twisting and criss-crossing. For 66 miles they weave a tangled knot beneath the jungles and beaches of Mexico's Yucatan Peninsula, transporting fresh water from the interior to the sea and forming the world's longest underwater cave system. And divers have seen only half of it. "We've explored a fraction, maybe 45 percent," says Sam Meacham, co-founder of the eight-person team that literally put Ox Bel Ha on the map. "If that's the case, it's the second-longest cave in the world, wet or dry, after Mammoth Cave."

Despite its monster size, Ox Bel Ha has not consumed any of the explorers who've dared to map it, a remarkable feat given cave diving's reputation as the world's most dangerous sport (431 deaths since the 1960s, a significant number considering the relatively few practitioners). In cave diving, panic leads to death, and it's easy to panic in dark, water-filled crevices deep beneath the earth's surface. "It requires an almost hypnotic state to keep you focused," says co-founder Bil Phillips, whose team has made 350 dives in the system over six years. "You must move slowly. The introduction of adrenaline would be a killer. Fortunately, we've got an experienced group."

After 350 dives in the system, explorer Bil Phillips is still obsessed with Ox Bel Ha. To date, divers have mapped just 45 percent of the passages.



deeper and laid survey line, with individuals sometimes using six tanks to make seven-hour, two-and-a-half-mile dives. They later incorporated rebreathers and underwater scooters. For the most part, the experience has been scare-free, although there have been moments. "One day we were standing around a cenote, and we heard screams for help," recalls Fred Devos. "One of our divers was cruising across the cenote behind a scooter with a crocodile on her heels. I picked up a log, but I'm thinking, 'What am I going to do with a log?'" Fortunately, the croc finally lost interest.

These days the edgiest thing about Ox Bel Ha isn't its size or the

crocodiles—it's the rapid rate of development spreading down the peninsula from Cancun. Sprawling resorts here inject sewage deep into the ground, a potentially devastating practice for the Yucatan's pristine water and caves. Meacham and Phillips are scrambling to educate folks about the resources just below their feet. "We started doing this for the thrill of exploration," says Meacham. "But now there's a different challenge, and it's hard, trying to preserve something people can't see."

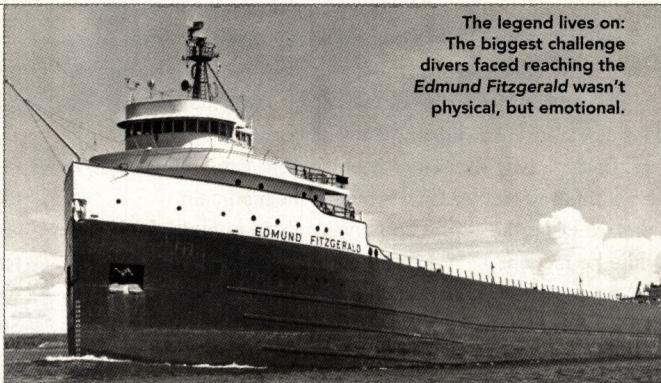
THE Edmund Fitzgerald

THE INSPIRATION for Gordon Lightfoot's haunting ballad lies in dark, frigid water 530 feet below the surface of Lake Superior. That's deep, no doubt about it. But what makes this site particularly edgy, in addition to its depth, are the buzz-saw emotions still connected to the *Fitz*, as Terrance Tysall and Mike Zee discovered when they made the first and only scuba dive there in 1995. "Logistically and physiologically, it was a challenge, and we just wanted to prove it could be done," recalls Tysall. "I had no idea people would respond the way they did."

On Nov. 10, 1975, the SS *Edmund Fitzgerald*, a 729-foot ore carrier, capsized in a monster storm in Canadian waters 17 miles northwest of Michigan's Whitefish Point. All 29 crewmen perished. Remote cameras later dispatched by the Coast Guard found the ship in two pieces on the lake bottom, the bow upright, the stern upside down. Since then, a handful of expeditions using ROVs and submersibles has visited the site, including Jacques Cousteau in 1980. In 1994, one expedition returned with photographs of dead crewmen and the intentions to publish them. Incredulous, surviving families had a judge block the scheme, and the Michigan legislature responded by outlawing photography of corpses on Great Lakes bottomlands.

So the pot had been well-stirred before Tysall, an explorer with the Cambrian Foundation, and Zee stepped off the R/V *First One* in 1995 and dropped quickly through blackness toward the *Fitz*. Descending face-to-face to monitor each other for high-pressure nervous syndrome, the pair breathed air for three minutes before switching to trimix at 250 feet. At 490 feet, they spied the wreck and then dropped another 40, landing on the port-side rail just behind the pilothouse. The dive wasn't without emotion. As Tysall would later write, "We gently gripped the ghostly rail with both hands. For the first time in almost 20 years, living hands were touching the *Edmund Fitzgerald*." After only 12 minutes at the site, they began a three-hour ascent with the help of two safety divers who shuttled them tanks of nitrox. Except for some minor glitches, the dive was a success.

To some *Fitz* families, however, it was an outrage. With their loved ones well-preserved in 33-degree water, the last thing fam-



The legend lives on:
The biggest challenge
divers faced reaching the
Edmund Fitzgerald wasn't
physical, but emotional.

ilies wanted were packs of divers nosing around, a sentiment that caught Tysall off-guard. "I think people were worried we were trying to be gruesome or something," he says, "but that wasn't the case at all." He promised the families he would keep his video footage—which he insists depicts no bodies—under wraps, even with the tabloid program *Hard Copy* clamoring for it. Still, the episode added urgency to efforts already under way by families to lobby Canada for a dive ban. In 2001, the parliament authorized the creation of strict regulations designed to protect all of Canada's "heritage wrecks." The details are still being hammered out, but diving the *Fitz* could very well be made a punishable offense. Richard Ingalls, a Detroit attorney who assists the surviving families, hopes that whatever regulations Canada produces will have teeth, in the form of heavy fines or jail time. Says Ingalls: "It's a grave site. Men are entombed in that ship. It deserves respect." SD

GET MORE > Are you ready to find your own personal edge? Turn to *In Depth*, page 105, section 3, to learn how to push your diving to the next level.

HOW DEEP IS DEEPEST?

Admittedly, we're being a bit subjective here with our superlatives. How, for example, does one determine the deepest dive? For the purposes of this particular envelope-pusher, we're talking open-water dives on open-water gear. Yes, a handful of folks have traveled deeper than 530 feet, the depth of the *Edmund Fitzgerald*. But those record-focused ocean plunges have amounted to little more

than digits on a dive computer. They've lacked a sense of place and could have been done anywhere. The one wreck dive arguably deeper than the *Fitz*, a 2000 expedition to the German battleship *Baden* off England's Channel Islands in 548 feet of water, deteriorated into a morass of invective among team members as to what if anything was accomplished. No one, on the other hand, questions the *Fitz* dive—not the guys who did it, nor the people they upset doing so.

Bring Back Fun

COOPERTOWN Elementary School was the perfect place to play when I was a kid, in the '60s. The one-story, '50s-modern affair in the Philadelphia suburbs was surrounded by playing fields, baseball diamonds and a basketball court. Adults were blessedly absent. Freed from supervision, we played pickup basketball games, chose up armies for toy gun battles or just rode our bikes aimlessly around the empty parking lot. Nobody "exercised." We were just having fun.

I drove by Coopertown's playground last summer, and noticed that things hadn't changed—same fields, same swings, same maddeningly unclimbable oak—except for the kids. There weren't any. Adults were all over the place, running, biking, hitting baseballs and playing, while the only child in sight was a little boy having a catch with his dad. It was an eerie kind of role reversal, like some playground version of *Planet of the Apes*. Where were the kids? My hunch is that a lot of them were at home, staring at glowing screens and having virtual fun.

Coopertown is just one example of a radical transformation of American society: Much of childhood has been moved indoors. And kids are paying for that change with their bellies. The percentage of American children who are obese has more than tripled over the last four decades.

Those nine million overweight kids face a potentially scary future. If they don't slim down by age 20, their life expectancy will drop by 20 years. An obese child is more susceptible than his normal peer to diabetes, heart disease, asthma and, maybe worst of all, sheer misery. A study published in the *Journal of the American Medical Association* this summer surveyed the physical activity, doctor's visits and sick days of obese kids and found their quality of life comparable to that of young cancer patients on chemotherapy.

The number of overweight American children has tripled in the last 40 years. One solution: Goofing around outdoors.

The media rightly blame the supersized American diet. The portion size of French fries, hamburgers and soda served in restaurants has grown by two to five times since 1977. But weight is an equation with two variables, so here's an equally alarming stat: The average teenager is 13 percent less physically active today than in 1980, according to Lisa Sutherland of the University of North Carolina at Chapel Hill. That's a lot of unburned calories.

What about sports and exercise programs? Kids aren't getting much of either. In the past decade alone, the proportion participating in daily school physical education classes dropped from 42 percent to 29 percent. But children don't always need teachers to get them in shape. In fact, one of the most effective fitness "programs" may consist of nothing more than letting a kid loose on a playground. A 75-pound child riding a bike burns 90 calories in 45 minutes, the equivalent of one large chocolate chip cookie. A kid who chooses to spend half an hour running around and another 15 minutes watching ants move crumbs uses more than 260 calories, the amount in a large cookie and a Coke. In other words, just acting like a kid once a day can make the difference in body weight of a pound a month. Add walking, swimming, biking to school or a weekly hike in the woods, and who needs to worry about exercise?

That's where you and I come in. *Scuba Diving*'s parent company, Rodale Inc., is launching a nationwide initiative on childhood obesity (see page 10). Meanwhile, Rodale's sports magazines

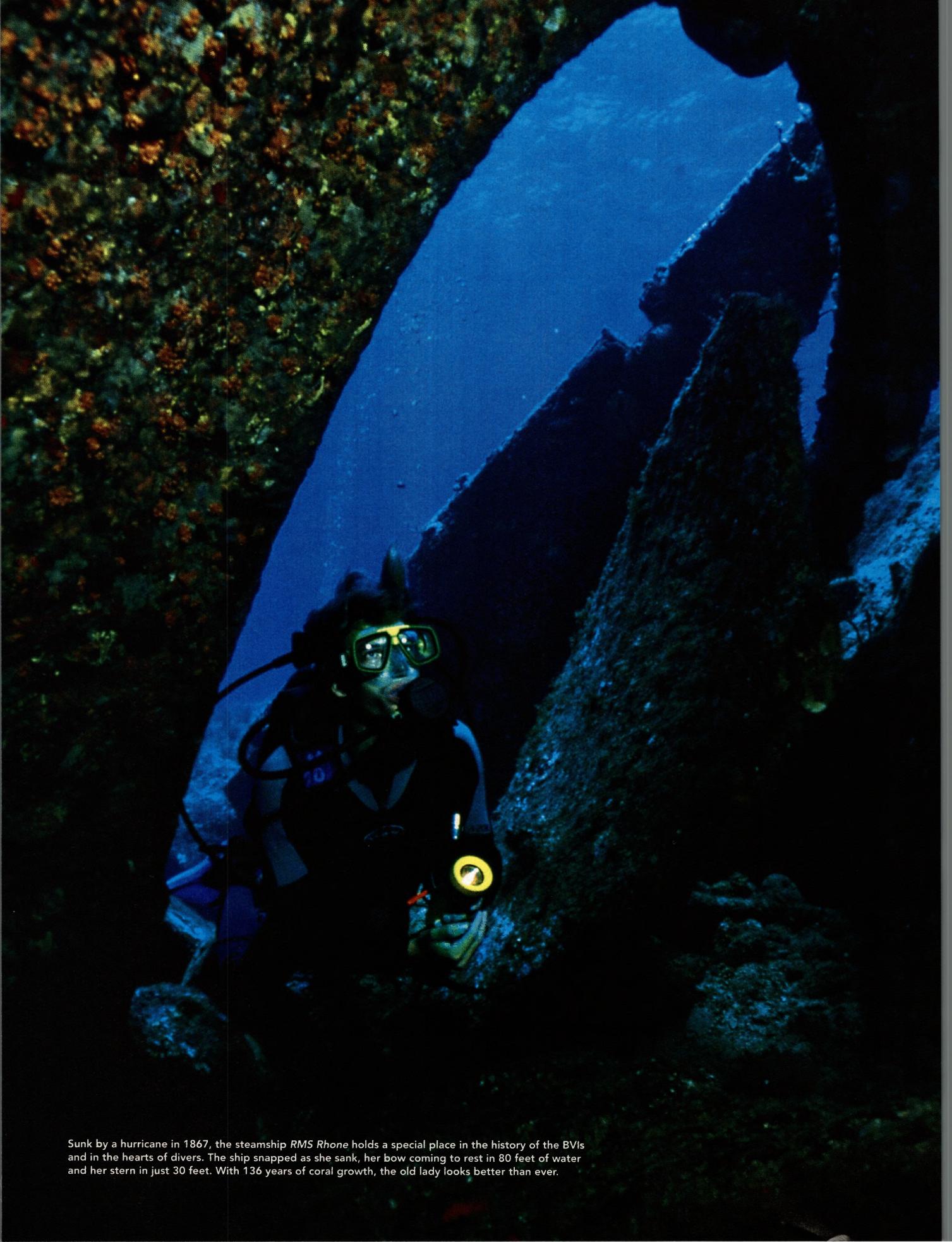


Make your children healthier:
Let them goof around outdoors.

(*Backpacker*, *Bicycling*, *Runner's World* and *Scuba Diving*) are studying the ways kids have fun on their own. We'll also study the ways adults can provide children safe opportunities for outdoor play. You'll see some answers in this magazine come spring.

My personal hypothesis? The number of overweight kids will start shrinking the moment we see playgrounds like the one at Coopertown fill up with kids. SD

GET MORE > Share your story and learn ways to get your kids to turn off the TV or computer and go outside at: www.scubadiving.com/kids.



Sunk by a hurricane in 1867, the steamship *RMS Rhone* holds a special place in the history of the BVI's and in the hearts of divers. The ship snapped as she sank, her bow coming to rest in 80 feet of water and her stern in just 30 feet. With 136 years of coral growth, the old lady looks better than ever.

B Y E T H A N G O R D O N

Log

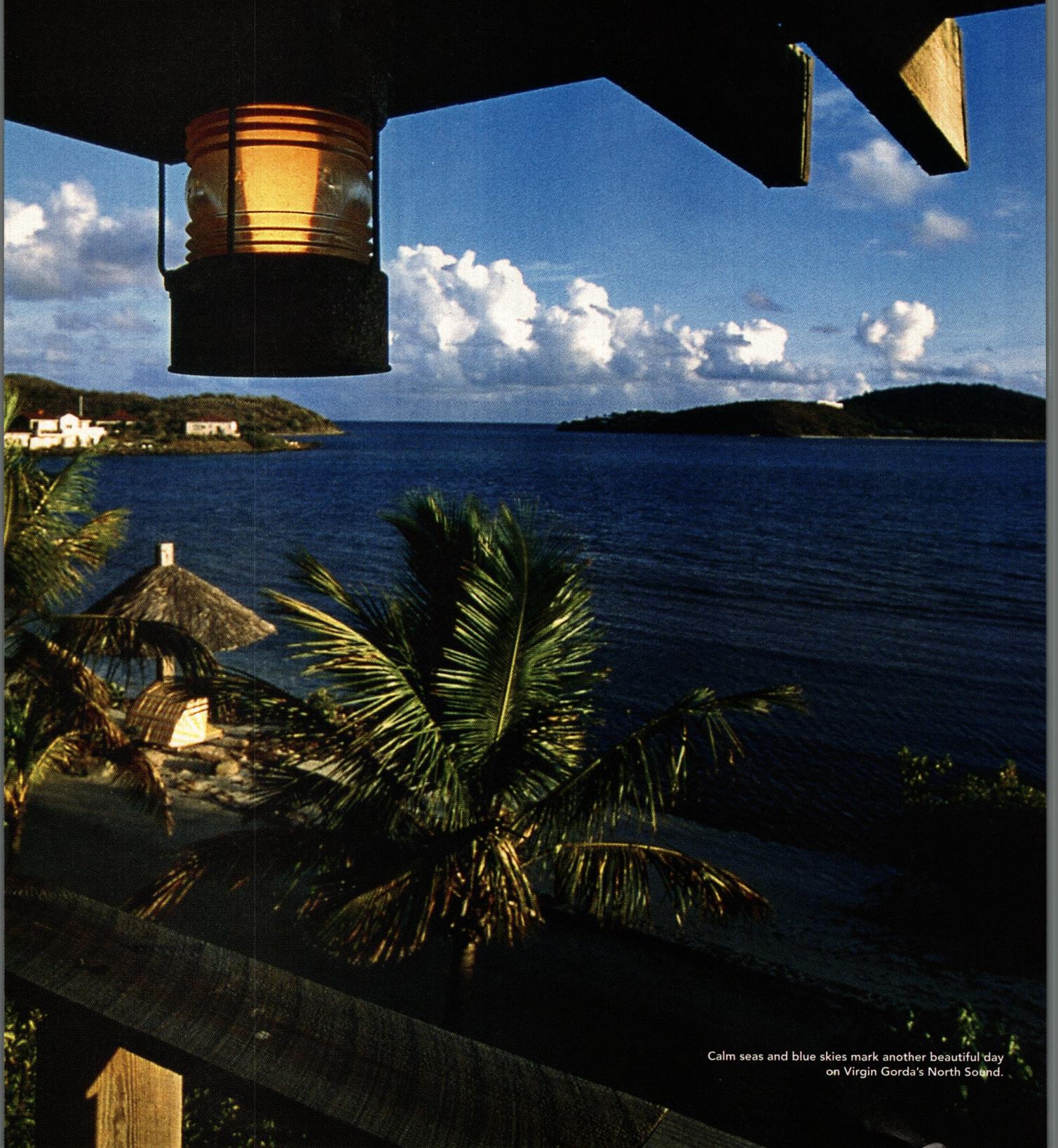
The British Virgin Islands

LEGEND HAS IT THAT Robert Louis Stevenson used the idyllic British Virgin Islands as the setting for his classic seafaring novel *Treasure Island*. It seems likely, given that many real pirates, including the infamous Blackbeard himself, used the 50 islands, rocks and cays that make up the BVI as a hideout. After a successful voyage, a crew of buccaneers could follow the trade winds, find a calm anchorage and slip away into the lush hillsides.

Times have changed, but the islands are still a great retreat. Today's trade winds bring in an armada of sailboats and powerboats to calm coves and picturesque beaches. A few may fly the Jolly Roger as a tribute to the past, but their mission is pleasure, not plunder. The hills where pirates kept watch are now topped with restaurants, resorts and bars.

World-renowned as the best sailing and boating destination in the Caribbean, the BVI are also an ideal destination for divers. Underwater explorers may not find Blackbeard's gold, but they will find a treasure trove of dive sites, from pinnacles to shallow reefs to wrecks.

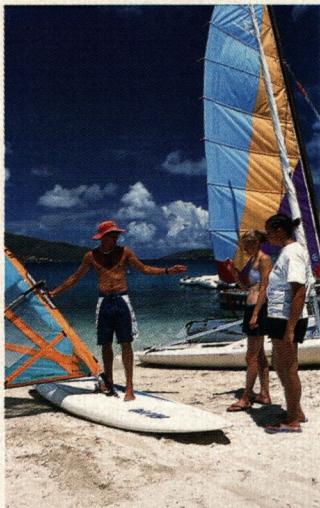
(A V I S U A L T O U R
A B O V E A N D B E L O W)



Calm seas and blue skies mark another beautiful day
on Virgin Gorda's North Sound.



Join the never-ending cat-and-mouse game between tarpon and a school of silversides at Seal Dog Rock. Below: Calm lagoons and steady trade winds make the BVI's a great place for windsurfing.



ASK ANY DIVER WHY THEY COME TO THE BVI'S and they'll probably tell you it's the variety of dive sites. Pinnacles, canyons, shallow coral gardens and wrecks are scattered throughout the islands, and no matter where you are in the BVI's, you're never more than a short boat ride from any of 40 moored dive sites. As an added bonus, most dives are found on a shallow shelf that rings the islands, so maximum depths rarely exceed 80 feet. This wide range of habitats attracts all kinds of marine life, including whale sharks, yellowhead jawfish and everything in between.

For wrecks, you will, of course, dive the *Rhone*—probably more than once. It takes at least two dives just to get an overview. And if the weather is right, don't miss the *Chikuzen*, a refrigeration ship that sank 12 miles northeast of Virgin Gorda in 75 feet of water. *Chikuzen* is an oasis for marine life on an otherwise barren underwater plain, but so far from shore, she can only be explored in the best of conditions.



Rush hour at Virgin Gorda: An armada of pleasure boats rides at anchor within swimming distance of the boulder-strewn beach known as The Baths.

THE COMPACT CLUSTER OF ISLANDS makes for a great sailing destination, and most of the boats you see anchored in the calm bays are for hire. You can become the captain of your own live-aboard, island-hopping to sample the diversity of dive sites, beach bars and restaurants. If you'd rather not have the responsibility of command, there are traditional live-aboards to choose from, too.

Land-based accommodations are equally diverse. Tortola and Virgin Gorda offer the most choices, ranging from amenity-rich resorts to intimate bed-and-breakfasts. Most of the resorts and inns are tucked into their own little bays and perched on the hillsides with great views in every direction. The larger islands are also home to stand-alone dive operations offering two-tank morning dives with afternoon and night dives when enough divers are interested.



The flower gardens at The Baths.

PACK LIGHT FOR YOUR TRIP TO THE BRITISH VIRGIN ISLANDS

because you'll spend most of the daylight hours in swimwear. Even the topside activities somehow involve the water. Windsurfing and sailing lessons are a fun way to pass the surface intervals, and they might whet your appetite for a future "bareboat" sailboat charter. A day at the Baths is a must. The idyllic beach offers hours of snorkeling in the tunnels and grottoes formed by massive granite boulders. The dry hikes, past scenic beaches and flowering gardens, aren't too shabby, either.

After a busy day of swimming through, sailing on or just lounging around the water, the best thing to do is find yourself a hammock with a good view of the ocean. Turn on the Buffett tunes, and enjoy a cold drink as the sun goes down. Gently rocked by the trade winds, you'll have found treasure for the soul.

SD

GET THERE > For more information about diving and water conditions in the British Virgin Islands, turn to *In Depth*, page 103, section 2.



A goliath grouper greets divers at the bow of the *Chikuzen*.

BEST NEW REGS

A STATE-OF-THE-ART BREATHING MACHINE AND A TEAM OF TEST DIVERS IDENTIFY THE CREAM OF A NEW CROP OF EASY BREATHERS.

IN JULY, we took 24 brand-new regulators to Panama City Beach, Fla., for three days of grueling tests on a state-of-the-

art ANSTI breathing simulator. We recorded more than 1,750 data points in 72 hours, enough info to fill a three-ring binder four inches thick.

Just two weeks later, six test divers took turns breathing off the same 24 regulators in the chilly water and 15-foot visibility off Catalina Island, Calif. A whopping 1,350 ergonomic data points were collected, along with pages and pages of test diver comments. This real-

world data was analyzed alongside the simulator data to paint a complete picture and reveal the eight best breathers.

The "RMVs" that we refer to in these reviews are respiratory minute volumes, or breathing rates. We tested

BY JOHN BRUMM each regulator at three different

RMVs to represent normal breathing, aggressive breathing and extremely heavy breathing. These breathing rates were then coupled with different test depths—132 feet, 165 feet and 198 feet. Each regulator was tested at each RMV at each depth.





TESTERS' CHOICE REGULATORS

ZEAGLE
Envoy

TESTERS' CHOICE
REGULATORS:
UNDER \$300

Zeagle Envoy

Zeagle's redesigned Envoy was the only reg in its price class to earn perfect simulator scores, even at the most demanding RMV/depth. It also delivered far and away the best in-water performance. An easy breather in all positions and extremely dry, the Envoy has a forceful purge and a dive/predive lever that is very effective in controlling surface free flows. The lever is also easier to use than most, even when wearing gloves, although its two settings are not clearly marked. Neither are the two high-pressure ports on the first stage; however, their positioning makes it possible to discern high-pressure from low-pressure ports without having to remove port plugs. While male testers found it comfortable, the rather long tongs on the Envoy's mouthpiece are uncomfortable for some women. Available with either a yoke or DIN valve. The Envoy offers the best warranty in its price group.

TESTERS' CHOICE REGULATORS:
\$300-\$400

Dacor Eagle Pro DPD Dacor's lightweight Eagle Pro DPD (for dive/predive) breathes like a dream on the simulator, earning very good to excellent scores at all RMV/depths. The balanced diaphragm first stage features Dynamic Flow Control (DFC), which provides consistent breathing performance at all depths. The main low-pressure port has a 170-degree swivel to simplify hose routing.

In real-world diving, the Eagle Pro DPD is easy to use. The second stage has a compact oblong shape with small purge button centered on the mesh-grid cover plate. The dive/predive switch couldn't be simpler. It has positive-click positions that are clearly marked so there's no question which mode you're in. The reg comes



ZEAGLE
Envoy Deluxe

with a comfortable mouthpiece and dives dry. The purge isn't as forceful as some, however, and the narrow exhaust tee produces above-normal bubble interference when vertical.

Oceanic O2 Tech Earning good to excellent simulator scores, Oceanic's O2 Tech—with its distinctive green and yellow second stage and DIN valve first stage—is designed specifically for mixed-gas diving. The reg uses a modified SP4 unbalanced piston first stage with specialized components, all assembled in a clean room environment to qualify for use with 100 percent oxygen.

Although the model we tested had a slight free flow, it nonetheless breathed smoothly in the swimming position as well as the heads-down and face-up positions. The second stage is comfortable and dry. It clears easily, using either the blowing method or purge button, which is a tad stiff. Available with a DIN valve only.

Zeagle Envoy Deluxe The Envoy Deluxe is similar to the Envoy, with the addition of a resistance adjustment knob that enables you to tune the regulator to diving conditions. It was the only reg in its price class to earn perfect simulator scores. The Envoy Deluxe's work of breathing was slightly better than the standard Envoy (a

OCEANIC
O2 Tech

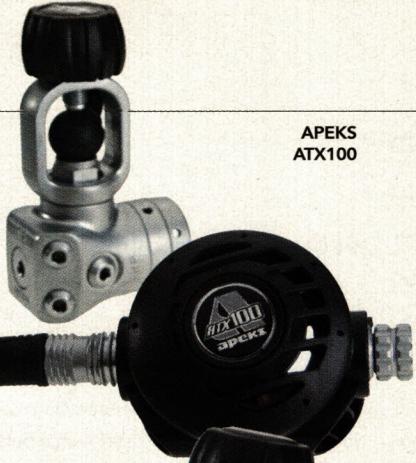


ATOMIC
AQUATICS
B2

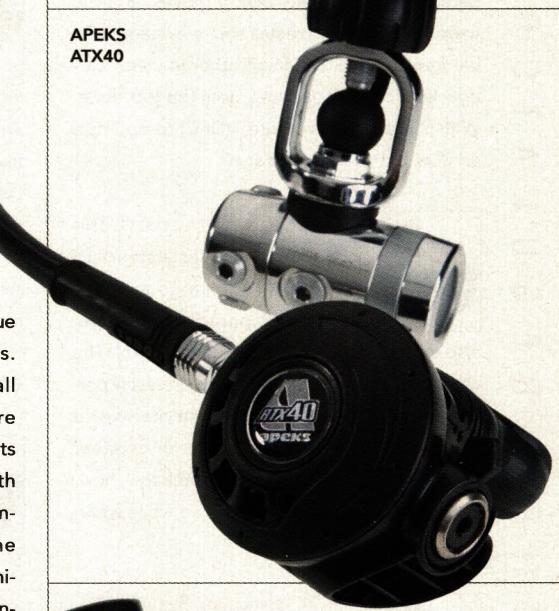
DACOR
Eagle Pro DPD



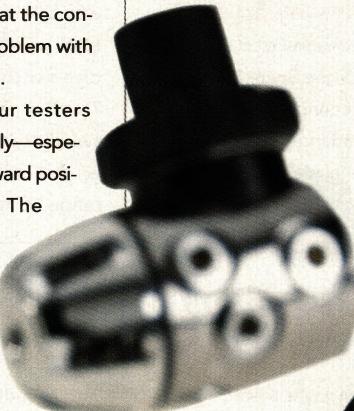
APEKS
ATX100



APEKS
ATX40



POSEIDON
Xstream Dive



diver probably wouldn't notice the difference, but our breathing machine did; again, thanks to the ability to adjust for optimum performance.

In the water, the Envoy Deluxe performs nearly identically to the standard Envoy. It's dry, a great breather and clears easily. The mouthpiece can be a problem for women with small mouths, but the adjustment knob is easy to use, as is the dive/predive lever, although it's not clearly marked. The Envoy Deluxe has one of the best warranties in its price class.

TESTERS' CHOICE REGULATORS: OVER \$400

Atomic Aquatics B2

Atomic's new B2 breathes effortlessly on the simulator, regardless of RMV or depth. But this isn't just a laboratory reg. The B2 earned the highest total score for in-water performance of any reg in any price class. It breathes easily in all positions and is the only reg to earn an excellent score for dryness. The B2 is equipped with a resistance knob and Atomic's Automatic Flow Control instead of a dive/predive switch. According to Atomic, this depth-activated venturi control automatically balances performance and stability as depth increases.

The B2's balanced piston first stage has a low-pressure port swivel to simplify hose routing. The second stage is built with titanium components and features Atomic's "Comfort Swivel," the best of a new generation of second-stage swivels, providing 30 degrees of motion between second stage and low-pressure hose. The B2's dual silicone mouthpiece, introduced last year, is still a favorite among testers.

Apeks ATX100 & ATX40

The latest incarnation of the successful TX series of regulators, Apeks' new ATX regs feature "over-balanced" first stages and balanced second stages that are smaller and lighter than their predecessors. They are top performers on the breathing machine, delivering some of the lowest across-the-board work of breathing rates in this year's test group.



When subjected to real-world diving conditions, both regs breathe extremely easy in all positions. They breathe dry, and clear easily using either the responsive purge button or the blowing method. They're both fitted with Comfo-Bite mouthpieces, which testers found to be very comfortable. Their dive/predive levers are efficient and easy to operate, even when wearing gloves, but are not clearly marked. The ATX40 has a convenient low-pressure port swivel on its first stage. The ATX100 has a second-stage adjustment knob that actually makes a difference in breathing, something that can't be said for all adjustment knobs.

Poseidon Xstream Dive This is a unique regulator in a number of ways. While performance limits on all other regs in this test group are found on inhalation, the Xstream Dive's limits are found on exhalation. It is designed with continuous positive pressure, so during simulator tests, while the reg delivered the absolute lowest work of breathing at the initial RMV/depth, it was predicted that the continual free flow was going to be a problem with test divers in real-world conditions.

Big surprise—not only did our testers find the regulator to breathe smoothly—especially upside down and in other awkward positions—but it also breathed dry. The positive pressure simply did not register as a problem or even as an annoyance with any of the test divers.

The compact second stage is very comfortable in the mouth, and bubbles vent off to the side. The only downside is the purge system—it takes a forceful breath to clear when using the blowing method. The small purge button is hard to find and hard to press—especially when wearing gloves.

REGULATORS UNDER \$300



Dacor Eagle This low-priced, entry-level reg boasts good to very good performance on the breathing machine. In-water tests show the small purge button to be a challenge while wearing gloves, and the narrow exhaust tee creates above-average bubble interference. But in all other in-water categories, this compact reg gets the job done. With Dynamic Flow Control (DFC) to optimize air flow to the second stage.



Dacor Eagle Sport This regulator marries a standard Eagle second stage to a balanced diaphragm first stage, also equipped with Dynamic Flow Control. The combination produces very good simulator performance at all RMV/depths. In real-world diving, the Eagle Sport is a smooth breather and is very dry. As with the standard Eagle, however, the purge is awkward to use while wearing gloves.



H2Odyssey Sprint XL Using the same first stage as the Sprint XS, the Sprint XL sports a larger second stage and generates much better breathing machine results. While a bit noisy on the inhale, the Sprint XL is a comfortable reg with an efficient purge. A small

exhaust tee, however, produces a lot of bubbles. The resistance knob is easy to use, even with gloves, but didn't have an effect on breathing performance in our tests. The dive/predive switch is minuscule and hard to grip.

**H2Odyssey Sprint XS**

The Sprint XS showed very good work of breathing when simulating normal recreational diving. But increase the breathing rate or depth, and the reg simply can't keep up. In-water tests reveal an inhalation stutter and a slight, but continuous free flow. A 360-degree swivel allows the hose wide range of motion from the bottom of the second stage, and there's a low-pressure port swivel turret on the first stage, both nice touches.

REGULATORS \$300-\$400

**Aeris Atmos Sport**

This is a solid, midpriced regulator that delivers good to excellent work of breathing on the simulator and respectable performance in the water. The second stage is a nice size and features an efficient purge. The small dive/predive switch is hard to grasp, but well-marked. The first stage has a primary low-pressure swivel that simplifies hose routing. However, the hose protector inhibits the swivel's range of motion.

**Apollo Bio A-120**

On the upside, the A-120's aluminum first stage is lightweight, and the second stage is compact and features a swivel. On the downside, the A-120's work of breathing is twice that of all other regs at the RMV/depth level most closely simulating recreational diving, which is the only test level the reg was able to reach without exceeding test parameters. In the water, the A-120's a noisy breather, but dry.

**Dive Rite RG2010**

This workhorse of a regulator gave a strong showing at the first three simulator RMV/depths and barely missed achieving the fourth. In the water, it's a smooth breather, although a bit damp in the heads-down position. The purge is stiff, but effective. The smallish dive/predive switch is clearly marked, and the resistance knob provides five full turns of adjustment. It comes standard with a DIN valve, but a yoke adapter is available.

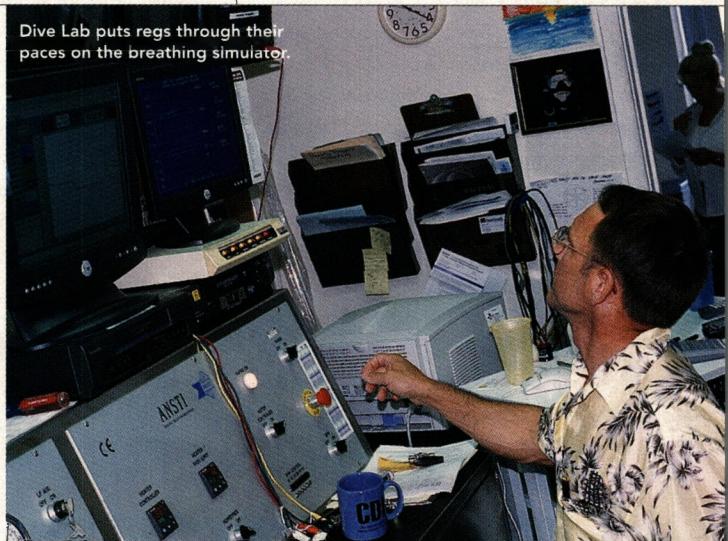
**Oceanic GT/CDX5**

This regulator provided good to excellent simulator performance. Put it in the water, and it breathes dry and smooth in most positions, although breathing is a little labored while upside down. The GT second stage is the lightest in Oceanic's line-up. Like all Oceanic's regs, an optional limited service agreement is available.

REGULATOR TESTING: ON THE SIMULATOR

The 24-regulator test bed was tested on an ANSTI wet breathing simulator at Dive Lab, an independent facility in Panama City Beach, Fla. Following surface checks, the regulators were tested at three breathing rates—37.5 RMV, 62.5 RMV and 75 RMV—at three depths each—132 feet, 165 feet and 198 feet—capturing seven data points per RMV/depth for a total of 70 data points per regulator.

Tests were performed at a supply pressure of 725-760 psi to conform to EN250 test standards, rather than the 1,500-psi supply pressure used by the U.S. Navy. If a regulator can perform well at the lower supply pressure, it will invariably perform wonderfully at higher supply pressures. A sampling of tests were also done at the 1,500-psi





Zeagle ZX/DS-V This is a strong performer on the simulator and in the water, and is a good breather in all positions.

It has a compact, environmentally sealed first stage and dry, comfortable second stage that clears easily using either the purge button or blowing method. The adjustment knob is easy to use, and the dive/predive lever is efficient though not clearly marked. It comes with one of the best warranties in its class.

REGULATORS OVER \$400



Aeris Atmos Pro We found the Aeris Atmos Pro doesn't perform quite as well as the less expensive Atmos Sport on the breathing simulator or in the water.

While it breathes easily in a swimming position, the Atmos Pro is more labored than most in the heads-down and face-up positions, and it tends to breathe wet. It has a responsive, but stiff purge. The well-marked dive/predive switch is hard on the fingers, but the resistance knob is easy to use.



Apollo Bio A-110 Moisturizing Reg The A-110's built-in clean air moisture system and in-line charcoal filter are interesting features, but when it comes to ease of breathing, this regulator trails far behind

the others in its class. In the water, it's a noisy breather. The second stage swivel is nice, though, and it does have an efficient purge.



Mares Proton Ice Mares' flagship regulator is made of metal, with heat retention and humidifying properties built in for cold-water diving.

Hooked to a serious-looking V32 first stage, the compact second stage offers a strong purge, but above-average bubble interference in most positions. A comfortable reg in the water, the Proton Ice delivered very good to excellent work of breathing on the simulator.



Oceanic Delta 3/TDX5

With its all-titanium first stage and compact second stage, this high-end reg is lightweight and comfortable, and simulator performance is solid. In the water, it's a nice breather in all positions and easy to clear, using either the purge or blowing method. The tiny, poorly marked dive/predive switch, however, is hard to see and even harder to use.



Oceanic Omega 2/DX4

The Omega 2 features an effective side exhaust and beefy second-stage swivel. It's a comfortable reg, a sweet breather in all positions, and boasts excellent work of breathing at the initial RMV/depth. It just doesn't have

the reserve capacity of other regs to handle the deeper test depths or more stressful RMVs at lower supply pressures. The purge is forceful, but its small button is hard to find and use, especially while wearing gloves.



Oceanic Zeta/CDX5

This mini-second stage is feather-light in the mouth. Bubble interference is minimal for such a narrow exhaust tee. Although a dry breather, the test Zeta had a tendency to free flow—especially in the heads-down position—but that could probably be tuned out on an adjustment bench.



Tusa RS240

With some of the highest in-water scores in its price class, the RS240 breathes dry and smoothly in all positions. The second stage has a swivel, an efficient purge system and a resistance knob with 10 positive-click settings. On the simulator, the reg delivered very good work of breathing at the initial RMV/depth. It is sensitive to lower supply pressures, however, so it doesn't offer as much reserve capacity as other regs in its price class. Within the bounds of recreational diving, this is a capable regulator.

SD

GET MORE > For more information, including performance charts on all regulators tested, turn to *In Depth*, page 106, section 5.

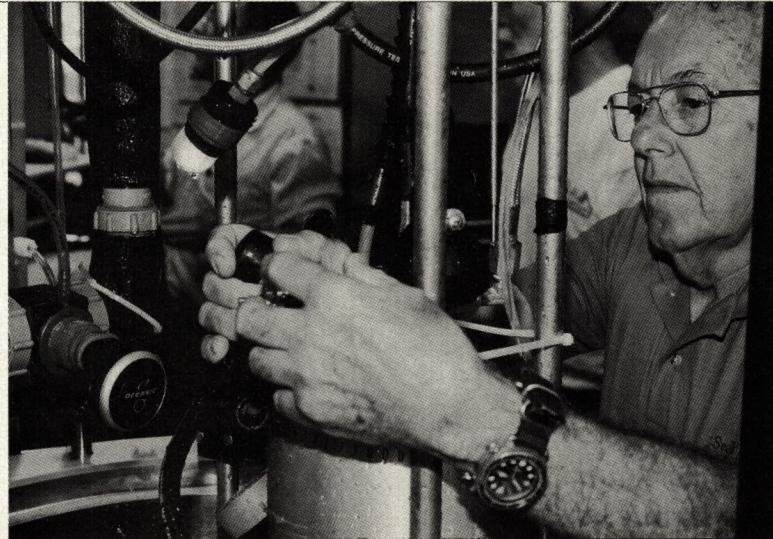
supply pressure for comparative purposes.

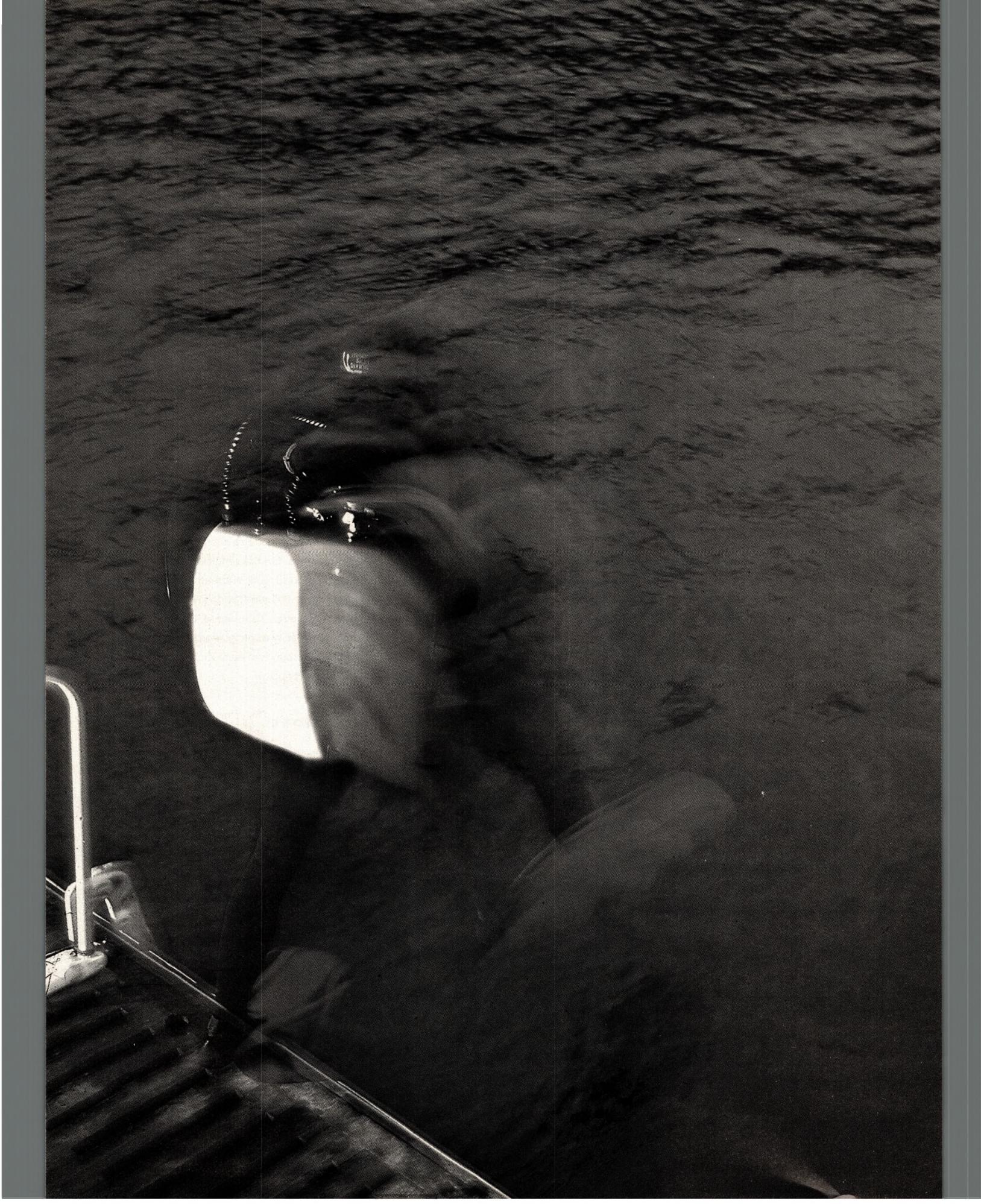
Note: Simulator tests are not intended to pass or fail regulators, but to scientifically gauge their performance based on controlled conditions. Breathing machine performance does not necessarily reflect in-water performance, simply because there are too many real-world variables that simulators can't measure. Breathing simulator results are important, but they tell only half the story. To read about the criteria evaluated in the in-water portion of the test, see page 106.

MANY THANKS ...

... to Mike Ward and Dive Lab in Panama City Beach, Fla., for work on the breathing simulator and Express Divers in Long Beach, Calif., for support of the in-water portion of the tests.

NICK LUCEY (LEFT & RIGHT)





LESSONS

FOR

Life

By Michael Ange

FILE :

67
#

(THIS IS A TRUE STORY,
BUT THE NAMES HAVE
BEEN CHANGED.)

THE DEEP SLEEP

Without a buddy to catch his mistake, one diver pays the ultimate price for carelessness.

BILL SWAM FORWARD, ENJOYING THE SILENCE OF HIS REBREATHER along with the relaxing, weightless sensation of being under water. The freshwater lake in his hometown wasn't exactly a diving paradise, but it was close, convenient and wet. Besides, with his new closed-circuit rebreather, he could move among the catfish and bream with surprising stealth. In all his years of diving, Bill had never felt so relaxed under water. A sense of euphoria enveloped him as he swam forward, and he never noticed his field of vision getting narrower and narrower. That sense of euphoria was the last thing that Bill would ever feel before dozing off, permanently.

DIVE ACCIDENTS, CLOSE CALLS
& HOW YOU CAN AVOID THEM

LESSONS FOR LIFE

THE DIVER

Bill was a professional in his early 40s who had reached a point in his diving career where he felt like he'd seen it all—been there, done that, got all the T-shirts. Diving was starting to bore him, until he discovered the cutting-edge technology of closed-circuit rebreathers.

This silent, bubble-free technology appealed to Bill, an underwater photographer who relished the opportunity to get closer to marine life. The units were expensive, but not above his means, so Bill purchased a top-of-the-line closed-cir-

ing told him the mechanical system was functioning properly. Satisfied, he swam away from the entry point and descended to his dive depth of around 40 feet.

THE ACCIDENT

Unfortunately, in his excitement to dive, Bill failed to turn on the rebreather's computer. His high-end system relied on a computerized net-



When the search and recovery team found Bill's body, there was no indication that he had ever realized the problem. His gear was still in place, and the mouthpiece of the rebreather was still firmly in his mouth.

cuit model and earned the proper certifications. Excited about diving again, he couldn't wait to start diving on his own with his new toy.

THE DIVE

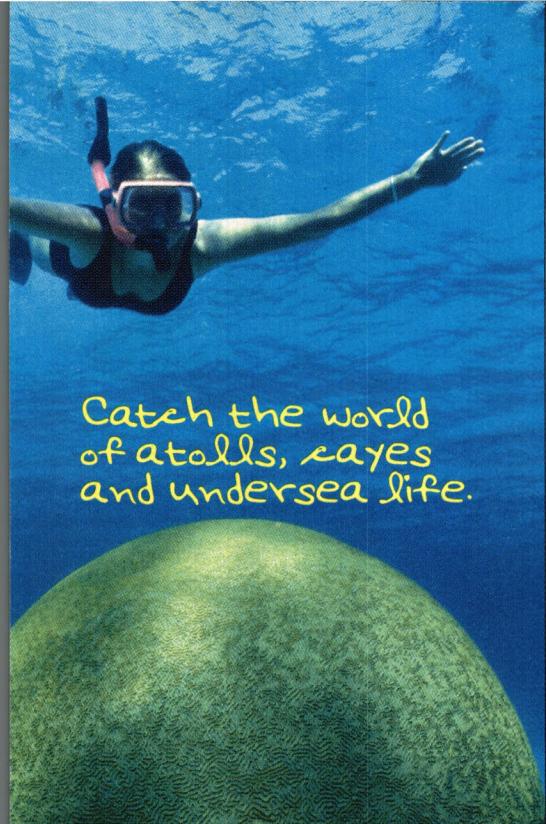
Shortly after completing his rebreather certification, Bill went to a local dive site to gain some more experience with his rebreather unit. Following his training, he meticulously set up the unit and completed all of his safety checks. As he approached dive time, his excitement and enthusiasm began to grow.

Bill entered the chilly water, taking several deep breaths and listening for the hiss of the demand valve that fed fresh air into the breathing loop. The sound of the valve inflat-

work of electronic sensors to monitor and control the oxygen level of his breathing loop. Without the computer control, there were also no alarms, no bells, no warnings of any type as the oxygen level began to drop.

Bill gained a false sense of security from the sound of the demand valve at the start of his dive. What he heard was the initial pressurization of the breathing bag with fresh gas, air in this case.

By design, the demand valve would have mechanically added gas



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to the system in order to adjust to the water pressure as Bill descended. But without the computer to read and react to the oxygen sensors, the rebreather unit could not know how much fresh air to add to the breathing loop in response to Bill's consumption of oxygen.

Once he reached a static depth, the system stopped compensating for pressure. The oxygen Bill was consuming was not being replaced, so he was getting less and less oxygen with every recycled breath. When the oxygen content fell below 16 percent, Bill would have felt the first sense of euphoria. As the oxygen in the loop dropped even more, he would have slipped into a deep hypoxic sleep—still breathing until the oxygen level was too low to support life.

When the search and recovery team found Bill's body, there was no indication that he had ever realized the problem. His gear was still in place, and the mouthpiece of the rebreather was still firmly in his mouth. There was ample gas remaining in both of the unit's cylinders.

ANALYSIS

Closed-circuit rebreathers are very sophisticated pieces of equipment. Unlike open-circuit scuba regulators or even semi-closed-circuit rebreathers (see "Rebreathers 101," pg. 103), closed-circuit rebreathers require meticulous attention to detail, rigorous maintenance and the completion of a checklist before every dive.

Based on what we know about this accident, Bill followed all the procedures necessary for the safe use of his unit except one. He failed to verify the operation of the electronic control module.

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Dive Easy



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Photo by: Mark Webster

Peter Hughes Diving

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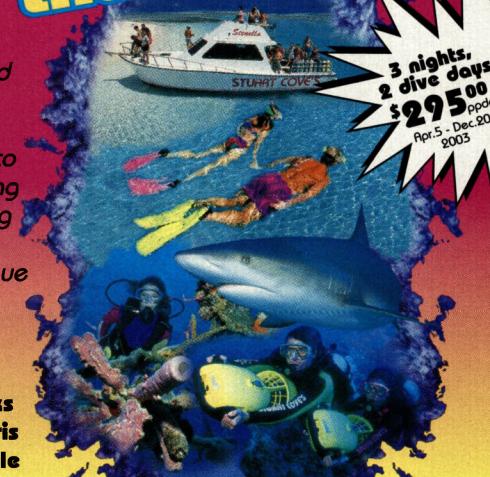


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LESSONS FOR LIFE

Once he reached a static depth, the pressure demand for diluent gas ceased. Without the computer to monitor his breathing loop and to add gas in response to his oxygen consumption, Bill had no way of knowing that he was depleting the oxygen in the system with every breath.

When investigators examined his gear, the control module was still in the pre-dive mode. If he had at least checked the module display upon descent, he would have realized the mistake and could have aborted the dive safely. In this case, a dive buddy may have also prevented this accident by ensuring that Bill check the readout before entering the water.

SD

LESSONS FOR LIFE

1 THE BEST DIVE TRAINING in the world is worthless if you fail to use it. Advanced forms of diving equipment like closed-circuit rebreathers require a strict adherence to checklists and safety procedures. Though his training properly covered all pre-dive procedures, Bill skipped the last step in his excitement to dive.

2 ALL DIVERS SHOULD VERIFY THE FUNCTION OF THEIR GAUGES and dive computers soon after entering the water. Failure to notice malfunctions or other issues early in the dive can lead to catastrophe. This is especially true for advanced equipment like rebreathers.

3 SOLO DIVING IS A SPECIALIZED FORM OF DIVING requiring advanced training and experience. Though Bill had a lot of dive experience, he did not take the proper safety precautions for a solo rebreather dive.

Gear



Small camera, big pictures: The Canon S400 Digital Elph in a Canon WP-DC800 housing.

MITCH MANDEL

PHOTOGRAPHY

Digital Roundup

The new and the noteworthy in underwater digital imaging. BY STEPHEN FRINK

BY NOW, it's no surprise that the world of photography is moving more and more toward digital imaging, with photo manufacturers putting most of their energy into their digital lines. Statistics from the Camera and Imaging Products Association show why that's the case: Digital camera shipments jumped 93 percent in the first half of 2003, while film cameras plunged 20 percent.

The manufacturers of underwater cameras and housings are well aware of the advantages of digital capture, including the most obvious advantage: instant review. The power of seeing the image on the camera's LCD screen immediately after pressing the shutter is empowering, and definitely accelerates both the learning curve and increases the percentage of "keepers" for an underwater shooter. Aside from a couple of notable exceptions, virtually all new products are in support of digital underwater imaging. Here is an overview of some of the latest and greatest, just in time for you to stuff the Christmas stocking of your favorite underwater photographer.

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DIGITAL ROUNDUP

1



1. Aquatica housing for Fuji S2

One of the best new camera options in the digital SLR realm is the Fuji S2. Like the popular Nikon D100, the S2 is built on a Nikon N80 platform, and accepts Nikon lenses. The big advantage to the S2 over any other digital SLR is that it functions in TTL exposure mode with modern submersible strobes.

The Aquatica housing for the Fuji S2 is ergonomically designed with a special eyepiece containing an integral diopter to assist in looking through this camera's rather tiny viewfinder. Zoom, manual focus, mode control, shutter speed, aperture and shutter release are easy to access without having to remove your eye from the viewfinder. Push buttons control the important functions on the back of the camera. Price: \$1,899 (housing and single Nikonos connector; w/o ports). Web: www.aquatica.ca.

2. Canon S400 Digital Elph in Canon WP-DC800 housing

The S400 Digital Elph is a powerful camera offering amazing features in a small package. With 4-megapixel capture, and a 36-108mm 11X zoom, the camera is a perfect casual tool for underwater photography. Simple buttons

2



engage all of the camera's relevant functions, and photographers can decide whether they want to shoot still images or motion jpeg. A diffuser helps control lighting using the built-in strobe, and a simple click to the close-up mode shifts minimum focus to only a foot away

in order to capture those tiny reef dwellers. Price: Camera, \$499; housing, \$169.95. Web: www.usa.canon.com.

3



3. Fantasea CP-4 for Nikon Coolpix 4300 and 885 digital cameras

The Fantasea CP-4 is a

compact injection-molded polycarbonate housing featuring a double-gasket seal and push-button controls. The camera simply drops into the housing with no muss, no fuss, and a latching buckle on the back door makes it very easy to prep for diving. Built-in flash and easy-view LCD screen make this camera both simple and intuitive for underwater use.

Actually, there are two models of the CP-4, differing only in the number of



accessible controls, both of which are affordable. In addition, there is now a CP-3 featuring minor internal modifications to permit the use of Nikon's popular Coolpix 3100 and 2100 lenses. **Price:** CP Sport, \$129; CP Pro, \$179 (prices include flood insurance for one year). **Web:** www.fantasea.com.

4. Ikelite housing for Nikon D100 This housing is a classic example of Ikelite ingenuity. It takes the company's tried and true Lexan SLR-MD for the front of the housing, uses its existing ports, and adds a new back plate machined from aluminum. A clear plate providing button access to all relevant controls is incorporated in the back. This provides an excellent view inside the housing, which is reassuring in the unlikely event water ever seeps inside. The Ikelite "Super-Eye" viewfinder is one of the better magnified viewfinders available today, and it is a big advantage when using a camera like the D100, which has a rather small viewfinder. **Price:** \$1,800 (w/o ports). **Web:** www.ikelite.com.

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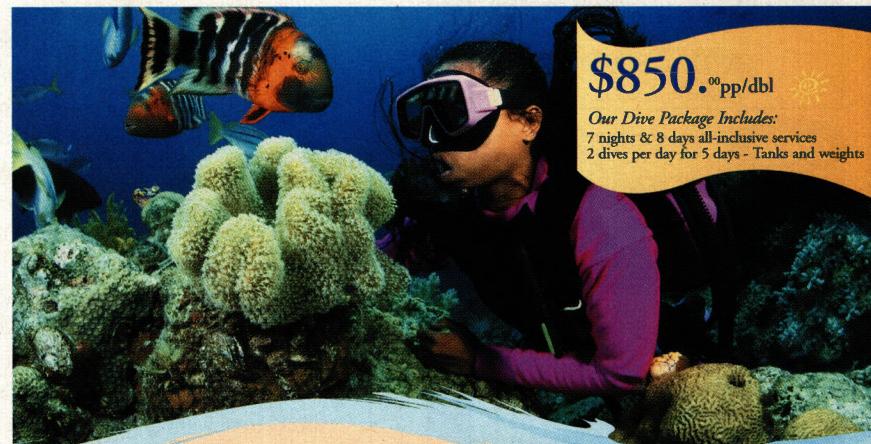
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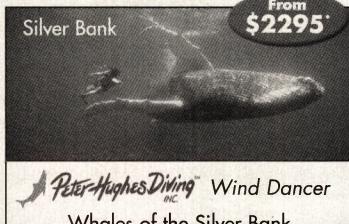

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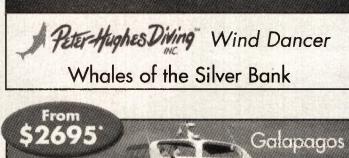
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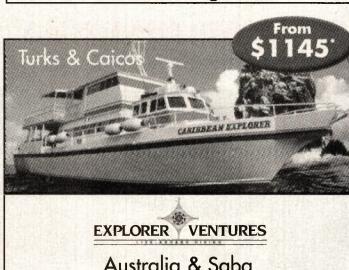


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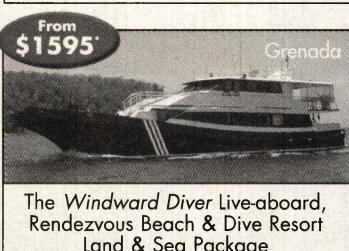


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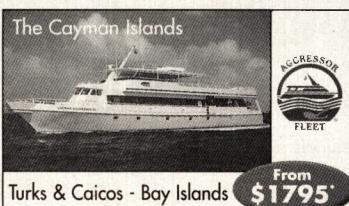
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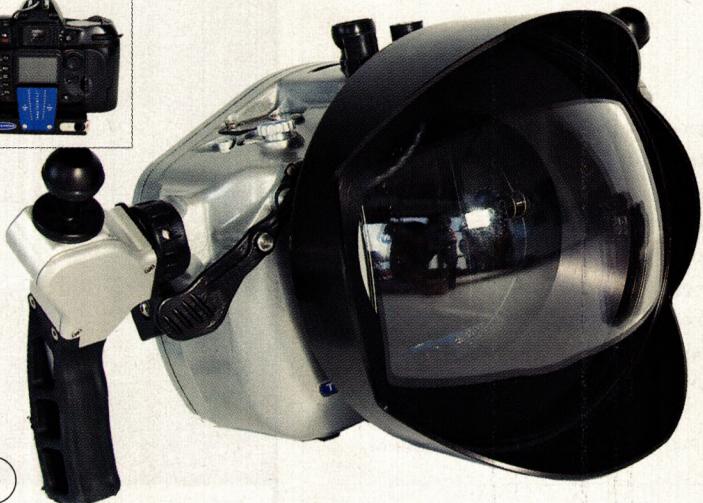
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DIGITAL ROUNDUP



5. Light & Motion Titan D100 housing

Specifically designed for the Nikon D100 6.1 megapixel SLR, the Titan system brings several new innovations to the camera table. The most significant is the fingertip control of most camera functions using both mechanical interface and infrared controls through clever "Smart Grips." The photographer can hold the housing securely by means of these ergonomic grips, and then just use his thumbs to toggle between shutter speeds, apertures and other oft-accessed controls.

Use Light & Motion ports or conversion rings to adapt Subal, Aquatica or Sea & Sea ports to the housing. The Titan also incorporates the impressive ROC strobe controller, allowing the photographer to choose between 12 manual strobe power settings on most TTL-compatible strobes. This provides the ultimate in light balance control between primary and secondary strobes, all without touching dials or

switches on the strobe. Price: \$2,699 (housing with two Nikonos bulkheads and two baseball mounts). Web: www.uwimaging.com.

6. Olympus PT016 housing for Olympus 300 and 400 cameras

Olympus has a close relationship with independent housing manufacturer UN in Japan, which allows UN to get an early start on the design end. Consumers benefit with housings often introduced at the same time as the camera. For example, the new 5-megapixel Olympus 5050 has already been housed, and at least 10 other Olympus housings are presently available.

The lens ports are threaded so that accessory macro and wide-angle lenses from both UN and Inon can be used to expand the range of photo subjects. For optimal color under water, the camera's built-in flash can be used, or a fiber optic receptacle allows the use of external strobes. A rubber lens hood shrouds the camera's LCD to optimize the view even in bright, shallow water. Price: Housing, \$149.95; 300 camera, \$359.95; 400 camera, \$449. Web: www.olympusamerica.com/underwaterhousing.

6



7. Sea & Sea DX3000 housed digital camera

Featuring a

3.24-megapixel Ricoh cam-

era on the inside, and a sophisticated polycarbonate housing on the outside, the Sea & Sea DX3000 is an ingenious system that takes digital imaging beyond point and shoot. The camera focuses very close, down to just 1cm, making it perfect for fish and macro imaging. Additionally, the front port offers a bayonet mount to accept both macro and wide-angle accessories from Sea & Sea's MX10 line of cameras, further enhancing field-of-view options. A flash shutter is built in to the housing to allow use of the camera's built-in flash or to deflect the light to a fiber optic port. This allows the use of several compatible Sea & Sea external strobes. The camera has eight megabytes of onboard memory, but also uses SD media cards in sizes up to



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256MB, and the optical 3X zoom offers a range of 35-105mm in 35mm equivalent. Price: Camera and housing, \$899. Web: www.seaandsea.com.

8. Sea & Sea AquaPix 3100
The AquaPix 3100 marks a significant milestone for underwater imaging: It is the world's first amphibious digital camera. Digital cameras that fit inside housings can be wonderful tools, but because this one was designed from the drawing board up to be used for diving, there are some intriguing features built-in.

The AquaPix 3100 is a 3.1 megapixel camera, complete with a 1.6-inch LCD preview screen, automatic shutter speeds from 1/40th to 1/100th second, 16 megabytes of onboard memory, and the ability to accept easily obtainable

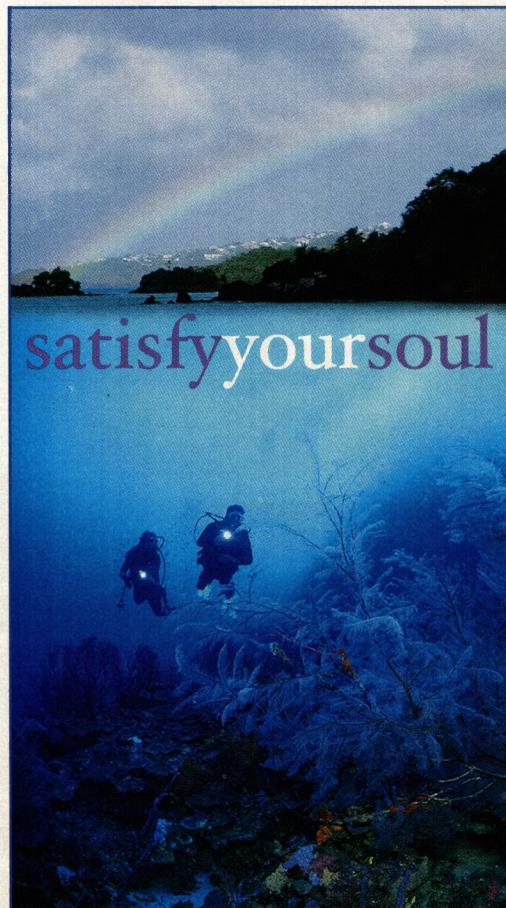
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DIGITAL ROUNDUP

SmartMedia cards. External O-ring-sealed doors provide access to battery and media on one side; USB output on the other side. The molded construction allows strobe lighting via the built-in flash or external flash via fiber optic cord. Additionally, there is both an internal color filter and a close-up lens that can be switched in and out of place using external levers. The macro lens will allow capture as near as 10cm, but the camera will also accept the bayonet accessories from the MX10 series, making the 20mm wide-angle an easy application as well.

Unlike other housings that feature a number of identical silver buttons, inviting the shooter to guess which button does what, the AquaPix has logical pictographs on rear buttons to indicate zoom, self-timer and image review/delete. This intuitive feature alone should make it the dive industry standard for rental use. I predict we'll be seeing

lots of these cute yellow cameras on dive boats around the world very soon. Price: \$619. Web: www.seaandsea.com.

9. Seacam housing for the Canon EOS1Ds

This is the flagship housing for Canon's 11.1 megapixel flagship digital SLR, and the tool that finally takes digital imaging beyond film in many respects. The Canon EOS1Ds is an acknowledged leader in the digital resolution race, and with the full-frame 35mm CMOS sensor on board, digital shooters get the same angle of view they were used to on their film cameras.

The Seacam housing features a resilient silver exterior finish and a black-flocked interior that traps light bounce or any stray drops of water. The ports are of mineral glass, with several different domes available, and flat



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ports to accommodate all popular macro configurations. However, the Seacam housing is best distinguished by its interchangeable viewfinders. The Pro viewfinder is relatively conventional, but both the Sport-180 and the Swivel-45 offer 1:1 magnified viewing and the ability to customize the viewfinder correction as much as plus or minus 3 diopters. Price: Housing, \$4,995 (w/o ports and viewfinder); Pro viewfinder, \$321; camera, \$7,999. Web: www.seacam-usa.com.

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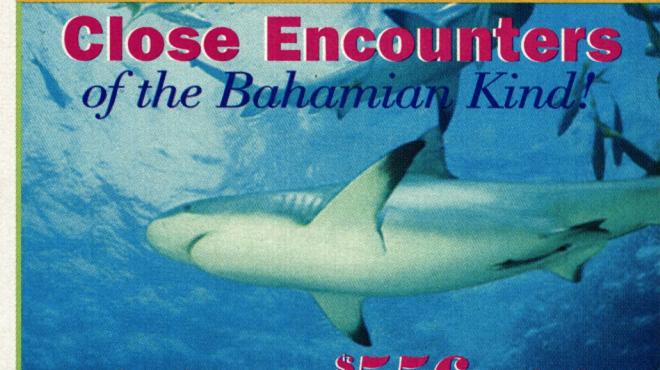
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9

10. Sealife Reefmaster DC310

Sealife pioneered underwater digital imaging with the introduction of its first Reefmaster iteration a few years ago, but its new DC310 brings on a whole new level of performance. The 3.3 megapixel camera features a 1.6-inch LCD display and unique one-button operation for the novice. More complete controls are available of course for those seeking greater technical sophistication. But in keeping with the Sealife devo-

tion to simplicity, the camera can be set in one of several custom modes.

The "Sea" mode features shutter speed and aperture optimized for the kind of conditions that might occur under water, while the "Land" mode is perfect when using the camera out of the housing or in "splash" applications. There is even an "External Flash" mode whereby the on-camera flash is bounced to an external slave strobe. This setting defeats the digital-pre-flash and assures that the external strobe operates in sync with the camera.

Internal memory is 8MB, and SD cards of up to 256MB can be added. Both macro and wide-angle accessories can be mounted to the lens of the DC310 by means of a secure bayonet, and images can be captured

as jpegs or AVI (motion jpeg movies). For even more simple operation at a very affordable price, Sealife also offers the 2.1 megapixel DC250. Price: \$599.95. Web: www.sealife-cameras.com.

SD

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Aeris Velocity Duo Fin Fresh from the factory, these Italian-made adjustable splits sport very thin, rigid side rails that give the fins shape while cutting down weight, a common complaint about traditional splits. Aeris has also added some molded foils along the edges of the split. With a closed-toe foot pocket and beefy heel strap, the Velocity Duo is available in four sizes and one color, titanium. Yes, we're looking forward to testing these babies. \$129.95. (Aeris, 510-346-0010, www.diveaeris.com)

High Tide 6.5 Pro Boot These rugged, cold-water boots have a molded sole to protect feet from rocks, ladder rungs and deck hardware. Good arch support and a reinforced heel help keep you stable on deck when you're loaded down with gear. An extra-cushy 7mm inner sole is comfy on the feet, and a full 6.5mm of neoprene on the uppers keeps them toasty. Heavy-duty zippers with Velcro locks and fin strap tabs on the heels help keep fins on and make them easy to get off. \$79. (High Tide, 518-669-3637, www.hightidegear.com)

Underwater Kinetics Uni-bag Bug hunters, rejoice—this nifty catch bag folds neatly in half and can be clipped to a D-ring. After snatching your catch, the bag's enormous hinged mouth swallows even the most cantankerous crustacean. If you prefer watching marine life to hunting it, the Unibag also makes a great gear carrier. A three-point strap system allows you to sling it from a shoulder or wear it like a backpack. The bag is made of polyester fabric on top to provide a slick surface for loading lobster, and polyester mesh on the bottom for quick drainage. There's also a mesh zippered pocket for stowing small, easy-to-lose items. \$29. (Underwater Kinetics, 858-513-9100, www.uwkinetics.com)

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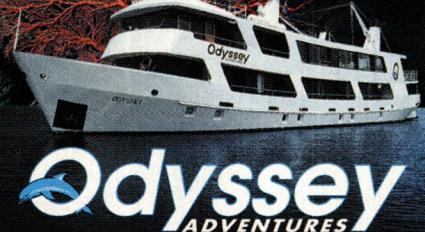
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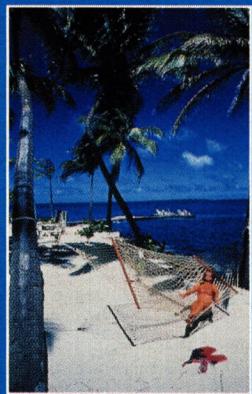
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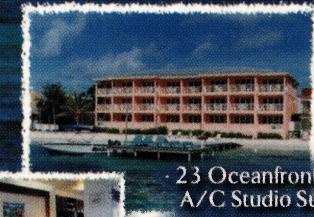
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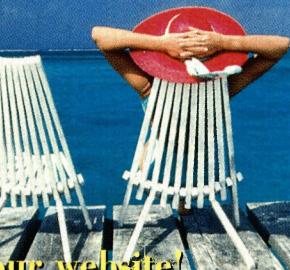
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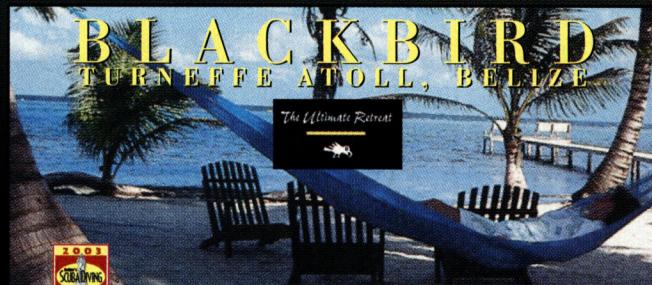


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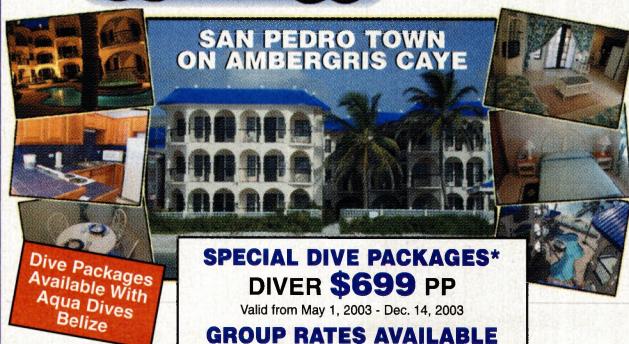
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A Day at the Beach

If everybody had an ocean, then we'd all be diving like Californ-i-a. Here's how West Coast divers handle the surf. — BY JOHN FRANCIS

IN CALIFORNIA, divers hit the surf about as often as surfers do. Diving from the beach has been an integral part of the California scuba experience since the '50s, when America first saw Mike Nelson run down the Santa Monica beach, throw a balsa-wood "tank" over his head and dive in to rescue a

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maiden in peril. Even today, most California divers complete their certification on beach dives, so handling the surf is just part of the learning curve.

Ask Cory and Jeremy Reddell. I ran into the boys (aged 14 and 15) at Biltmore Beach, Santa Barbara, where they were finishing their certification class. Bob Reddell, a proud father if ever there was one, watched and looked forward to the beach dives he'll soon be making with his sons.

They live within driving distance of several great diving beaches, and because it costs little more than the price of air fills (a dive boat would cost about \$100 each), the three can afford to dive often. Other beach divers like the freedom. "You can pick your own site, as uncrowded as you want it to be," says Michael Adams, 32, of Thousand Oaks. And for multi-tasking divers, you can't beat the convenience of shore diving on your schedule, not a dive boat's. "I can dive in the morning and then make it to work," says Monica Hamblin, 25, of Camarillo.

SURF'S UP!

Of course, there's that tricky surf problem. By far the most intimidating part of beach diving is getting through the surf zone. That's the area between where the wave first breaks and where the roller degenerates into confused white water rushing up the beach. Before you get out to the rollers, you can generally stand easily in the white water. Once you're outside the break, you can float comfortably because the water is moving only vertically, not horizontally, toward the beach. But in between those two areas, a breaking, rolling wave

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can overpower the strongest diver.

How do you get through the surf zone?

Timing is everything. You probably know about sets and lulls: Sets are groups of bigger waves and are always followed by lulls, groups of smaller ones. You know you're supposed to wait for the lull before going out, but you may not know the secret to timing it.

Here's a common rookie mistake: You watch one big wave after another pound the beach until the next wave seems to be a smaller one. "Is this the lull?" you ask. A couple more small waves follow. "Sure looks like it," you think. Then comes another wave, still small, but a little bigger than the last. "It's the lull, but I'm losing it! I have to go now!" So you stumble out, just in time to meet the returning set of big waves.

Decide at the outset, "I will not go out on the first lull I see no matter how easy it looks. I'll wait for the second or third." Or fifth or tenth if you have to. By standing and watching for a few minutes, you'll get a better idea of what the lull looks like that day. You'll also have a chance to relax a little.

That's when to go into the surf. What about how?

FINS ON? FINS OFF?

There are two ways of getting through the surf. One method, the one usually stressed in certification courses, is to put your fins on at the edge of the water and shuffle backwards or sideways as far out as you can, then swim under the breaker. The other is to carry your fins in your hand, walk on your feet past the surf zone, and then put on fins. Both methods have advantages and

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disadvantages, and neither is best for every diver, every beach and every day. Experienced beach divers use both methods at times.

The "fins on" method has a lot to recommend it. When you fall down with fins on, you have propulsion. With any luck, you can swim through or under the

waves and power past the surf zone. The problem with it is that walking through the water in fins is slow and unsteady. You can most likely forget about waiting for the lull because it will be over before you've gone far. You'll probably fall down and won't be able to get up again. You're also more apt to trip or slip on

rocks just past the shoreline where it may be too shallow to swim.

On the other hand, if you walk out carrying your fins, you can go much faster, so you spend less time in the surf zone and, with luck, get past it before the lull is over. On your feet, you're much better able to sidestep rocks and retain your balance, to advance or retreat quickly if you need to. If you fall, you probably can get up again. Bill Kendig, 41, of Ventura, puts it succinctly: "Walking works best with feet."

Kendig, a California beach diver since 1975, is also a NAUI and PADI instructor and can appreciate both methods. "Which is best depends a lot on the kind of beach. If it's a gradually sloping beach and slow surf, it's easier to walk until you're waist deep and put your fins on there. If it's steep and the surf is big, you're better off having all your gear in place first."

As Kendig implies, a steep beach usually means a "shore break," where the wave breaks almost directly onto the sand. The surf zone is shorter on a steep beach, so your chance of getting through

Fins on or fins off? It depends on the conditions.



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it on a lull is better, but the waves are probably bigger and more violent, too.

Bodysurfing or board-surfing experience helps you decide how best to approach the surf. "I learned a lot about beach diving from being a boogie boarder and bodysurfer," says diver Michael Adams. "I don't mind being in the surf. I feel comfortable with it."

If you're not comfortable going into the surf, Kendig has a suggestion: Go out first with no dive gear, just your wetsuit, to learn where the surf zone is and what the wave action is like. Next, add mask, fins and snorkel only, and try to go out through the surf. "If you can go out easily with mask, fins, snorkel and wetsuit, you can do it with your scuba gear," says Kendig. "And if you're having difficulty, that's a good time to say, 'Hey, forget it,' and not do the beach dive."

One last tip: When a big wave bears down on you, try to go under it, not through it. That means going out with little or no air in your BC.

THAT TWO-LETTER WORD

It can be hard to say "no" to the dive when you're standing at the water's edge, your buddy is flexing his pecs and you've already hauled all that gear to the beach. But, as Kendig says, "People get hurt because they try to force what they want to do on the conditions." In fact, among the divers I've talked to, it's those with the most beach dive experience who are quickest to call off a dive if surf conditions look doubtful.

"If everyone in the group feels comfortable, we go, but if anyone is hesitant, we call it off and grab breakfast," says DeeLee Bersbach, 26, of Thousand Oaks.

Monica Hamblin remembers one dive she and a buddy attempted even though conditions were less than ideal. After being beaten up by the surf, getting tangled in the kelp and discovering

zero vis, they had to abort. "And then we had to wash our gear," she recalls.

Two tricks make it easier to say no. First, leave your heavy gear in the car when you make the pre-dive recon in wetsuit only. If conditions look good, return to the car, put on the rest of your gear and go. If they don't, you haven't

wasted so much effort. And second, have a backup plan so you don't feel you have to dive because your alternative is a wasted day. Have in mind another site. West-facing beaches are often calm when south-facing ones catch the swell, for example. And if all else fails, remember you're going to the beach. Can that

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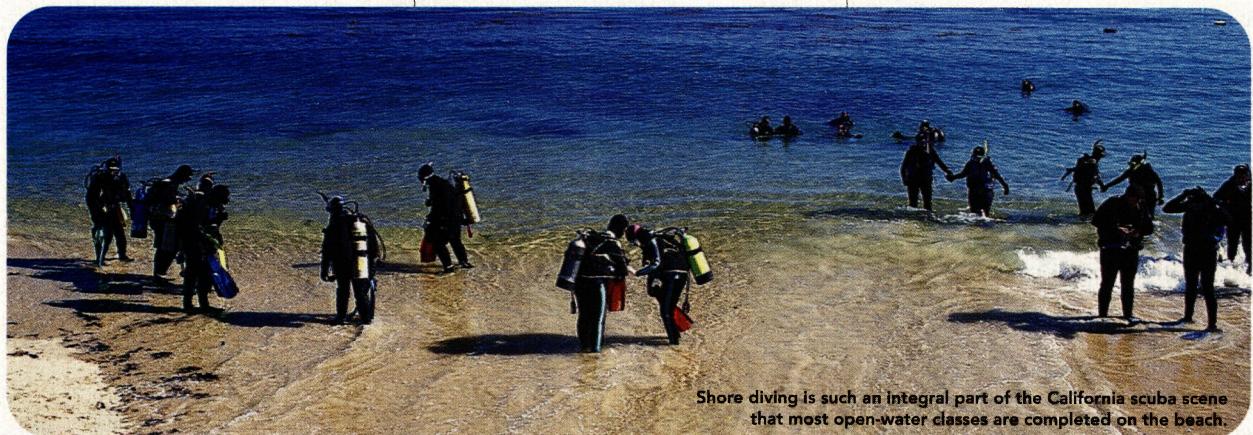
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Shore diving is such an integral part of the California scuba scene that most open-water classes are completed on the beach.

be so bad? "So many times we've had more fun just bodysurfing on those days it's too big to dive," says Kendig.

SURF EXITS

Returning to the beach can be more, uh,

exciting than going out. The surf may have gotten bigger while you were on the bottom, and even if it hasn't, waves are always harder to judge from the ocean side. Once again, timing is key, and that requires the patience to wait for the right

moment. Approach the beach until you're just outside the surf zone, put some air in your BC and rest there while you wait.

While you're regrouping, watch where the waves break. You want to get

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as close to the break as you can without being carried over the top, but be careful: Bigger waves break farther out. Watch where the waves go up the beach and move sideways to the best starting position. You want to be carried onto sand, not onto rocks or kids with inner tubes. Spend some time watching the sets and lulls, and find their rhythm. You're looking for the moment at the beginning of a lull when a wave is just passing under you.

At this point, there are several methods for getting onto dry sand. If the waves aren't too big, you can, as Kendig puts it, "kick like hell until you're in chest-deep water, then rip off your fins and run like hell." But be careful: Waves are almost always bigger than they look from the outside. If they look too big to outrun, another method is to deflate your BC and

10 TIPS FOR BETTER BEACH DIVING

- > To keep sand out of your wetsuit, your reg, etc., gear up at the car and walk straight to the water without stopping. Bring a tarp to stand on behind your car and a plastic tub to dump your gear in after the dive.
- > Take several jugs of rinse water. They'll get warm in the trunk of your car.
- > To change clothes in public, one option is the Changing Room, a mini-tent (www.gochange.com). Another is a huge caftan or bathrobe. But most divers work with a big towel and a car door.
- > Keep gauges clipped in and use an octo holder.
- > If you get knocked down by a wave, don't try to get up—especially with fins on. Just crawl on all fours, or swim.
- > Once past the surf, swim out on your back. Look at a fixed point on the beach to see if a current is carrying you down the beach. If you need to reach a specific point like a buoy, take a compass bearing from the beach and use the reciprocal.
- > Take a sharp knife or shears. There's more fishing line near shore and in kelp beds.
- > Be aware that surf and incoming tides usually mean poor visibility. Vis usually improves farther from shore.
- > To find the best entry points, ask lifeguards. Many are surfers or divers.
- > Have an emergency plan: Where's the pay phone or cell phone? Who do you call? Where's the oxygen? Tell someone where you will be.



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swim in on the bottom. You'll find very little turbulence only a foot or so below the rollers. When you get into water too shallow to swim, don't try to stand up in your fins; instead, crawl out on your hands and knees like a toddler.

And if the surf has become really big, try this: Outside the break, take off your tank and BC and inflate the BC. Take off your weight belt and strap it around the tank, through the BC's armholes. Tuck the hoses under the belt. Push the whole thing ahead of you toward the beach, using it like a boogie board. If you're separated from your tank and BC in the surf, push them ahead and away from you. You'll both end up on the beach, but the heavy scuba equipment won't be on top of you. Wearing only your mask, fins and wetsuit, you'll be able to ride the wave easily.

ON THE BEACH

Of course, huge surf days are the exception, not the rule, at California's popular beach dive sites. More often, it's one of those gentle, sunny days that provide perhaps the best reason for beach diving: It's easily a social or family event. Maybe grandma watches the kids make sand castles while mom and dad dive, then everybody picnics on the beach. Maybe your surface interval means digging your toes in the sand and reading a fat novel or listening to a Dodgers game. Or maybe it's a long, quiet walk on the beach. Choose a site with a campground and complete the postcard picture by grilling the day's catch over the campfire, watching the sunset, then crawling into your tent or camper to avoid the drive home. Or better still: Suit up for a night dive.

SD

Rebreathers 101

Why semi-closed systems make sense for recreational divers. BY MICHAEL ANGE

AN OPEN-WATER diver asked me recently why anyone would want to dive with a rebreather. The question surprised me. Who wouldn't want the comfort, ease and the access to marine life that only a rebreather can provide?

As we talked, I realized that this diver was a victim of several common misconceptions about recreational rebreathers—that they're too expensive, too complicated, that you have to be a rocket scientist to make sense of a dive system that's equal parts black magic and high tech.

Wrong, wrong and wrong. In fact, semi-closed nitrox rebreathers are no more expensive than a top-quality scuba system, are easily used by recreational divers, and use basic technology that dates back to the 1800s. With the proper training, any diver worthy of his open-water C-card can handle a semi-closed rebreather—no voodoo or advanced degree required.

KEEP IT SIMPLE

Many divers have confused recreational semi-closed rebreathers with the cutting-edge closed-circuit rebreathers favored by the military and hard-core tech divers. The two systems are about as different as a single-engine Cessna is from an F-18. Both work on the same general principles, but the simplicity of the semi-closed systems makes them the logical choice for recreational pursuits.

By way of explanation, let's review

those general principles. Since the 1600s, explorers knew they could extend a diver's time under water by recirculating his breath, and since the 1870s they have been devising ways to do it. The science is simple: When we inhale a breath of air, we take in a mixture of approximately 21 percent oxygen and 79 percent

Semi-closed nitrox rebreathers aren't as complicated as they look and cost about the same as a complete set of high-end scuba gear.

nitrogen. When we exhale that same breath, the oxygen content is around 16 or 17 percent, the difference in gas volume being made up of carbon dioxide. All but about four or five percent of that exhaled air is reusable.

A rebreather has two functions: remove the carbon dioxide and replace the consumed oxygen. Most divers immediately worry about the oxygen, but in reality the most important task is removal of carbon dioxide. A diver will die from hypercapnia (carbon dioxide poisoning) much more rapidly than he will from hypoxia (lack of oxygen).

This reaction has two interesting and beneficial by-products—heat and water vapor. Once the breath is



scrubbed, it flows into a counter-lung or breathing bag where the oxygen is replenished. When the diver inhales again, he gets a warm, moist and properly oxygenated breath.

THE DIFFERENCE

Replenishing the oxygen is where

rebreather systems can get complicated. Some advanced closed-circuit systems use multiple computer-controlled oxygen sensors that require careful preparation and monitoring.

On the other hand, semi-closed rebreathers are very simple. A pre-mixed gas, typically nitrox, is continuously

added to the breathing loop in a very small measured dose—imagine a controlled leak that constantly flows gas into the breathing bag. The flow rate is based on a simple mathematical calculation of the amount of oxygen the diver typically uses. If any electronics are used in semi-closed systems, they are simple monitoring devices that tell the diver the partial pressure of oxygen in the breathing loop.

Semi-closed rebreathers do allow some gas to escape throughout the course of a dive. Despite this occasional venting of breathing gas, most divers can count on between 90 and 180 minutes of dive time on a single cylinder of less than 30 cubic feet depending on the gas used. The final limitation compared to the more complicated closed-circuit designs is a 165-foot depth limit due to nitrox operating limits.

THE ADVANTAGES

Most divers who try rebreathers do so in order to get closer to marine life. The acoustic and pressure waves of exhaled bubbles can be a huge impediment to marine life interaction. Dolphins, sharks and whale sharks are all notoriously skittish around bubble-blowing divers. I can tell you from personal experience, however, that the occasional small stream of breathing gas vented from a semi-closed rebreather has no effect on hammerhead sharks and other marine life.

The warm, moist breathing air of a rebreather is also a physiological advantage. The thermal stress caused by breathing cold compressed air is fairly dramatic. Divers will frequently find themselves diving in much thinner wet-suits and much colder water than they would attempt in open-circuit gear. The moist air also prevents dry mouth, and both of these factors lessen diver fatigue.

Rebreather divers also enjoy the freedom of movement made possible by a truly lightweight, one-piece breathing unit, but the real advantages semi-

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closed rebreather systems have over open-circuit scuba systems are cost, ease of use and weight. There are several semi-closed systems that, when completely configured and ready to dive, weigh less than a standard 80-cubic-foot cylinder. A fully capable semi-closed system includes everything to replace your BC, regulator, pressure gauge, octopus and cylinder.

THE LEARNING CURVE

You do need to complete a special certification class to use a semi-closed rebreather because the experience of using one is quite unlike open-circuit scuba.

For starters, the dynamics of breathing on a rebreather are different. As you get comfortable diving the rebreather, you will notice that the loudest sound you hear is the sound of gas entering your lungs. No mechanical valves opening, no metallic clicks of first stage seats and no hiss of high-pressure air. Unlike breathing on open-circuit regulators, high-pressure air is not shoved down your throat with every breath. Breathing under water becomes as natural as breathing on the surface.

The next thing divers notice is the need to retune buoyancy control. Because the air from the lungs is shifted to the counter lung during exhalation, there is no change of buoyancy like that experienced during exhalation on traditional gear. Rebreather divers must be careful on ascent—all that expanding air can bring you to the surface a little quicker than expected if you don't take the proper steps to slow your ascent. Most semi-closed systems have a built-in buoyancy compensator that works just like a traditional BC.

Finally, there is training in maintenance. Recreational semi-closed systems can be assembled almost as quickly as open-circuit gear. There are a few additional steps, such as filling

the scrubber canister and checking the gas flow through the system with a small flow meter provided by the manufacturer. Just like with your open-circuit gear, you also have to check the unit for leaks prior to the dive. Disassembly is a bit more complex for some people, especially if you're like most

divers and don't properly clean your open-circuit gear. Washing and disinfecting the breathing loop is required after every day of diving to prevent infections, mold and mildew from growing in the breathing loop, but this added step takes the average rebreather diver less than 10 minutes.

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A FEW MORE QUESTIONS

> IS IT SAFE? For properly certified divers using brand name products, semi-closed rebreathers have one of the best safety records in our sport. Just be sure to get the proper training. The average semi-closed unit course requires about four to five academic hours and four open-water dives.

> IS IT EXPENSIVE? Not when compared to a full set of top-quality scuba gear. For under \$2,000, you can buy a semi-closed nitrox rebreather that serves all the functions of a BC, regulator, pressure gauge, octopus and cylinder. The daily cost of diving a rebreather on a typical two-tank charter is pretty close to the cost of diving open-circuit nitrox. The cost to fill the scrubber canister is about \$10, and you'll need one

nitrox fill for the 30-cubic-foot supply tank. Both will easily last for two dives at recreational depths. If you are diving for the weekend, some units have enough scrubber capacity for both days of diving (four-plus hours of bottom time), driving your cost down to about 65 percent of the open-circuit nitrox.

> IS IT WORTH THE EFFORT? No matter where you dive, there are many benefits to semi-closed rebreather use for recreational divers: warmer, more comfortable dives in cooler climates; relaxing on the bow while everyone else changes tanks between dives; the best video and photos you've ever taken of marine life; and let's not forget the "oohs" and "aahs" you'll hear from others on the boat.

> WHAT TRAINING DO I NEED? The standard prerequisites for

a semi-closed rebreather course are open-water certification and basic nitrox certification. Some training agencies require advanced open-water certification. You'll also need to have between 25 and 50 logged dives.

Courses are offered through:

- **American Nitrox Divers International (ANDI)**, (516) 546-2026; web: www.andihq.com.
- **International Association of Nitrox & Technical Divers (IANTD)**, (305) 751-4873; web: www.iantd.com.
- **National Association of Underwater Instructors (NAUI)**, (800) 553-6284 or (813) 628-6284; web: www.nauitec.com.
- **Professional Association of Diving Instructors (PADI)**, (800) 729-7234 or (949) 858-7234; web: www.padi.com.
- **Technical Divers International (TDI)**, (888) 778-9073; web: www.tdisdi.com. 

DIVE DEALS



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Before you book your next trip, check out the special packages available exclusively on scubadiving.com/divedeal. There, you'll find special offerings from these top dive operators, resorts and dive travel specialists:

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Occidental Grand Aruba
Pelican Adventures
Red Sail Sports Aruba

BAHAMAS

Blackbeard's Cruises
Stella Maris Resort Club

BAY ISLANDS

Anthony's Key Resort
CoCo View Resort

BELIZE

Bay Adventures

BONAIRE

Great Southern Islands Adventures

CAYMAN ISLANDS

Bay Adventures

COSTA RICA

Adventure & Dive Tours & Travel of Costa Rica

DOMINICAN REPUBLIC

Coral Canoa Beach Hotel
& Spa/Sea Pro Divers

LIVE-ABOARDS

Fiji Aggressor
Peter Hughes' Sun Dancer II
M/V Caribbean Explorer II
M/V Nimrod Explorer
M/V Turks & Caicos Explorer

MEXICO - COZUMEL:

Bay Adventures
Iberostar Cozumel
Scuba Club Cozumel

MICRONESIA

Sam's Dive Tours

PUERTO RICO

Caradonna Caribbean Tours

U.S. - FLORIDA KEYS:

Dive Key West

U.S. VIRGINIA ISLANDS - ST. THOMAS:

Aqua Action



Grace Under Pressure

Panic may be the No. 1 cause of scuba fatalities, and experienced divers are not immune. Here's how to keep your cool when things turn rough under water. **BY SELENE YEAGER**

BY NATURE, most divers are as laid-back as Jimmy Buffett. We have to be to sail out to sea, toss on a tank and plunge into the dark unknown. Yet, there's a little Woody Allen dwelling within each of us, threatening to turn dangerously neurotic should the tides turn. That's the essence of panic. You go from cucumber-cool to scared, disoriented and out-of-control. Though new divers are more susceptible, experienced divers are also at risk, especially when a dive goes awry.

Panic can kill in many ways. Rapid, shallow breathing can cause hypoxia and a buildup of carbon dioxide. The result: The diver acts irrationally, breathing faster, expelling the regulator or bolting to the surface. These panic responses can make you pass out, or even have a heart attack if you have a weak heart. And panicking impedes your ability to solve problems and get to safety when your equipment malfunctions or you're tangled in a line.

The National Underwater Accident

Data Center attributes about one-fifth of diver deaths directly to panic. Another 22 percent of fatalities cannot be attributed to a specific cause. But considering the number of divers found with working equipment, ample air supply and their weight belts firmly cinched, most experts believe that death due to panic is more common than we think.

WHAT? ME WORRY?

Trying to predict who will panic is a little bit like guessing who will win *Survivor*. With enough analysis, you could probably figure it out, but you're just as likely to be surprised, especially because panic strikes so many divers. A national survey from the mid-1990s shows that more than half of experienced divers reported having at least one panic or near-panic experience.

Not surprisingly, people who have panicked on dry land are at an increased

risk for losing control and panicking under water. In a study published earlier this year, dive panic researcher and psychiatrist David Colvard, M.D., found that 45 percent of men and 57 percent of women with a history of panic reported panicking on one or more dives, compared to 19 percent of men and 33 percent of women who had never panicked before. "If you have been diagnosed with panic disorder, you should be very hesitant about jumping in the water," says Captain Marie Knafele, M.D., Ph.D., who has performed nearly 20 years of diving research for the Navy. "If you really want to dive, find a very small class with a lot of personal attention and time in the water."

Some experts report that women are also at a higher risk for panic. The 1995 Sea Grant study from the University of Wisconsin-Madison found the incidence of panic was 64 percent among women compared to 50 percent among men. Knafele is skeptical that predisposition to panic is really a genetic quality, however. "Women may be more likely to admit when they feel panicked," says Knafele. And they're also more likely to get into diving because their partner wants them to rather than of their own accord, she says. "That immediately puts them in a more vulnerable position. Scuba is something you should really want to do for yourself."

Finally, people who tend to react to adversity with anxiety are also more likely to panic when faced with a flooded mask or a great white looming overhead. There are "trait anxiety" tests that could ferret out these nervous divers before they ever earn their C-cards, but most experts agree that's unrealistic. "Certified divers tend to fall in the lower range of trait anxiety to begin with, and the people who score high may simply be more anxious; they don't necessarily have panic disorder or other mental illness," says Colvard. Subjecting every

potential diver to a psychological profile would be difficult, if not a violation of anti-discrimination laws.

The bottom line is that panic is something instructors need to address more seriously, and that participants need to prepare for more ardently, says Knafele. "You need to honestly assess your own anxiety level. If you're a high-stress individual, you'd be wise to stay in the pool until you feel confident in your skills and ability to stay calm. If you are able to keep your wits, you can get yourself out of most any situation, even if your equipment fails."

PRACTICE MAKES POISED

Being scared under water is a rational fear, says Knafele. "The only reason we're all not panicking all the time is that we're trained, so we know what to do." Enough knowledge, practice and preparation can soothe even the most anxious scuba enthusiast.

Rehearse the basics. Practicing basic skills is essential for preventing panic. "New divers especially need to rehearse important skills until they are burned into their psyche," says Colvard. Experienced divers also should brush up on the basics. Practice sharing air, clearing your mask and other skills you may not have done since certification. Visualize and mentally rehearse each dive.

Plan for emergencies. Panic happens when rational fears become irrational, says Knafele. "Have an emergency procedure ready for every situation. Plan what you will do if you see a shark, have equipment failure or lose your buddy. Then rehearse those procedures with your dive buddy, so if something scary happens, you both automatically know what to do."

Remember "SBTA." Physiologically, it is almost impossible not to calm down when you're breathing slowly and deeply from your diaphragm, says Colvard. Train yourself to "Stop—Breathe—

Think—Act" when something unexpected happens.

Come prepared. Having the proper equipment will bring you great peace of mind. Have a wetsuit for cold water, a backup light for night diving, and anything you need for special circumstances like wreck dives. Never fudge it or use equipment you aren't familiar with.

Listen to your instincts. If a dive doesn't feel right, don't do it. Period. Never dive beyond your training and abilities or push it when the conditions aren't cooperating.

Plan pauses. Prevent unpleasant surprises with pauses at every main transition, like when you enter the water, are at the bottom, before you ascend, at your safety stops and so on. Take a moment to assess your gear, your buddy and the environment.

Fix the little problems before they snowball into big ones and you'll go a long way to warding off panic, says Colvard. "It's usually not one thing that sends you over the edge, but a combination of unexpected factors." SD

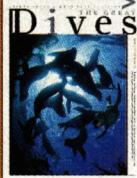
WHEN PANIC ATTACKS

The following are classic signs that you're losing your cool. If you experience any of them, stop to relax, breathe, think—and seek help.

- > Rapid breathing or feeling like you can't get enough air.
- > Rapid heart rate, palpitations or heaviness in the chest.
- > Gastrointestinal distress, "butterflies," nausea, vomiting or diarrhea.
- > Muscle tension, headache or tremors.
- > Trembling voice or inability to speak.
- > Sweating, chills or hot flashes, feeling out-of-control or impending doom.

Depth

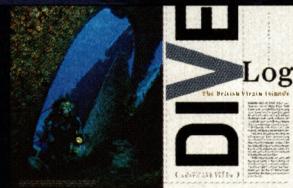
1



GREAT DIVES • Santa Barbara, Channel Islands, p. 17 > Santa Barbara is located 38 miles from Long Beach, Calif. Visibility averages 30 to 50 feet with peaks of 80 feet in the summer and fall. There is normally little current, though there can be significant surge in the shallows. Expect water temperatures ranging from 58 degrees to 68 degrees. For more information on Santa Barbara dive operators, go to dive.scubadiving.com/tripfinder. **Wakatobi, Sulawesi, Indonesia, p. 18** > Located in the Tukang Besi island group, Wakatobi is a three-hour direct charter flight from Bali. The only resort in the archipelago is the Wakatobi Dive Resort, which is open from late March through the end of December; it's closed during the wet monsoon season in January and February. For more information: www.wakatobi.com. **Ustica, Mediterranean Sea, p. 20** > In Palermo, Sicily, you can board a ferry to Ustica, but the hydrofoils can get you there in half the time (in about an hour and a half). May to October are the best months to dive. Dive Operators: On Ustica—Alta Marea, info@altamareustica.it. For more information: viaggia.com.

ETHAN GORDON

2



DIVE LOG: BRITISH VIRGIN ISLANDS, P. 60 • **Getting Around:** You'll definitely want a rental car on Tortola, though you can get by with cabs on Virgin Gorda. Exercise caution on hilly Virgin Gorda, where a normal set of brakes lasts about six months. Don't forget when driving in these British isles that left is right. **Documents:** U.S. and Canadian citizens need at least a birth certificate and photo ID to enter, though a passport is best. **Currency:** U.S. dollars are the official currency. Credit cards and traveler's checks are widely accepted. **Weather:** Winter highs average in the high 70s, with summer highs in the mid-80s. **Water Conditions:** Decent visibility; expect 50 to 100 feet. Water temps are in the low 80s year-round. **Just In Case:** The closest recompression chamber is on St. Thomas in the U.S. Virgin Islands (809-776-2686). **Dive Operators:** For information on British Virgin Islands dive operators, comprehensive travel guides, special dive deals and recent trip reports submitted by users, go to dive.scubadiving.com/tripfinder. For more information: www.britishvirginislands.com.

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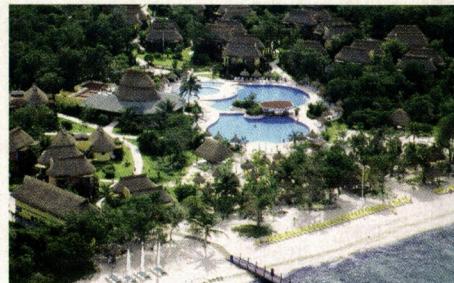
With 11 great locations in the Caribbean, Iberostar Hotels & Resorts is offering a number of great packages this fall and winter that are aimed at Rodale's Scuba Diving readers.



Scuba divers who purchase an all-inclusive stay at Iberostar Hotels & Resorts with a travel agent or wholesaler can then take a giant stride online to save 15% on dives with Dressel Divers (www.dresseldivers.com). The discount, valid for students and certified divers, can be enjoyed at any of Iberostar's great Caribbean choices.

Iberostar and Dressel Divers offer smart dive vacationers value and selection. In Mexico, divers can choose between cenotes, world-famous reefs, wreck dives, and much more. In the Dominican Republic, dive travelers will find dramatic wall dives, wrecks, and maybe even humpback whales.

In addition, Iberostar Cozumel (which was featured on E! Entertainment Television's Wild On Mexico) is offering a special "Fall Fiesta" package that allows guests to explore the wild and wonderful side of Cozumel. The seven-night package includes round-trip airfare from Houston, five two-tank dives, and a 50-minute massage. The resort is just 20 minutes from the airport and offers convenience to famed Palancar Reef and nine dive trips daily (plus three snorkeling trips).



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Rates are just \$1,149 per person, double occupancy, which includes all meals and beverages, nightly entertainment, a children's program, other activities, and gratuities. In addition, a group special is also available, with eight paying and the ninth being free. Package rates are valid November 1-16, 2003, and must be booked through Caradonna Caribbean Tours at (800) 328-2288 or www.caradonna.com.

3

THE EDGE



P. 52

The Coldest: The North Pole > You probably won't be headed to the North Pole itself—no commercial operators go there—but companies like Arctic Kingdom (www.arctic-kingdom.com) and Global Adrenaline (www.globaladrenaline.com) can ferry you well above the Arctic Circle, where you'll explore underwater icebergs and swim with belugas and narwhals. For maximum comfort under the ice, you'll need not only a dry suit but appropriate duds beneath: a well-fitting undersuit made of high-tech microfibers, wool socks and a cashmere scarf. Before you go, take an ice-diving specialty course, and you'll learn why you should purchase a cold-water regulator or adapt yours with a cold-water kit. **The Highest: Licancabur** > While you likely won't be gunning for any 19,000-foot crater lakes, there are plenty of high lakes in the U.S. worth exploring, like Lake Tahoe at 6,227 feet, with its huge schools of fingerling trout and rugged granite formations. For information on specific Tahoe sites, contact Sierra Diving Center, www.sierradive.com. Above 1,000 feet, you'll either need dive conversion tables or a computer that can be set to compensate for altitude, which many do. Remember that an increase in altitude often means a decrease in water temperature, so plan accordingly. PADI offers special training in altitude diving. **The Hottest: Kilauea** > First, you'll need life insurance. Secondly, if DeRoy deems you experienced enough—and that means uber-experienced—he might take you lava diving, but only if conditions are perfect. Contact him at his Nautilus Dive Center in Hilo, www.nautilusdivehilo.com. Otherwise, content yourself with witnessing the sculpted results of Hawaii's many ancient and recent lava flows—the dramatic arches, tubes, caves, canyons, pinnacles and domes that lie off each island. Of particular note: Sheraton Caverns off Kauai, Makaha Caves and Shark's Cove off Oahu, Cathedrals off Lanai, and Kaiwi Point, Golden Arches and Chimney off the Big Island. **The Deepest: Edmund Fitzgerald** > Legally and emotionally, you'd do well to avoid the *Fitz* altogether and concentrate on, say, the equally famous *Andrea Doria*, the 700-foot liner that went down off Nantucket in 1956. She rests in 240 feet of water, and Mad Dog Expeditions, www.maddogexpeditions.com, leads trips for experienced dry suit and trimix divers. Of course, diving beyond 120 feet presents serious decompression issues, so you'll need plenty of tech training before dropping in on any deep wrecks. Both NAUI and TDI/SDI teach extended range and mixed gas courses, and every agency offers a wreck specialty. **The Longest: Ox Bel Ha** > Ox Bel Ha remains off-limits to all but the current explorers, but you can plunk into another Yucatan system, Dos Ojos, the world's third-largest, and experience 300-foot visibility, giant rooms and ceilings studded with limestone daggers. Contact Hidden Worlds Cenotes, www.hiddenworlds.com.mx. Fred Devos, of Meacham's OBH team, certifies cave divers and leads jungle tours to the Yucatan's more far-flung systems, www.aquaexploration.com. Open-water dive gear won't cut it in the gear-intensive world of cave diving, so prepare to invest in, among other things: double tanks, a dual-orifice isolation manifold, primary regulator with seven-foot hose, guideline reels and at least three lights. Cave diving also demands loads of intensive training, so contact TDI/SDI (www.tdisdi.com), NAUI (www.naui.org) or the National Association for Cave Diving (888-565-6223; www.safecaving.com).

4

Travel



COSTA RICA TRAVEL GUIDE

P. 36 • Water Conditions

> Caño Island is affected by ocean currents and swells, but the biggest variables are currents and thermoclines. Water temperatures average 78 to 80 degrees, but can drop sharply below thermoclines. Shallow depths make the diving accessible to divers of all skill levels. The only challenge is the occasional brisk current, which usually isn't a problem because the boat follows you. **Electricity** > 110 volts, 60 cycles. **Language** > Spanish, but English is spoken widely in tourist businesses and developed areas. **Currency** > The Costa Rican colón. U.S. dollars are usually accepted in tourist areas, but you may have to accept a street exchange rate 10 to 20 colones below the official rates. Colones are needed for small purchases. Credit cards may trigger surcharges. **Health** > Assume tap water is unsafe to drink and stick to bottled water. Food is generally safe if you follow standard precautions, eating only cooked food and fruits or vegetables you peel yourself. **Documents** > U.S. and Canadian citizens need a valid passport for an automatic 90-day tourist visa. U.S. citizens over the age of 17 may be able to get in with a valid photo ID and a birth certificate, but a passport is best. **Dive Operators** > Aguilade Osa (www.aguiladeosa.com) offers a full range of scuba gear, a 30-foot dive boat and two-tank trips—including palm-shaded lunch on Caño—for \$110. Other Osa lodges with full dive service include: Jinete de Osa (www.drakebayhotel.com), Pirate Cove (www.piratecovecostarica.com), Drake Bay Wilderness Resort (www.drakebay.com) and La Paloma Lodge (www.lapalomalodge.com). **For More Information** > Costa Rica Tourist Board, www.visitcostarica.com.

BEST NEW REGS, P. 66

MANUFACTURER Product Name	PRICE	WARRANTY	MADE IN	REGULATOR FEATURES								ERGO PERFORMANCE					
				1st STAGE	PORTS	2nd STAGE	2nd STAGE ADJUSTMENTS	FACTORY-READY NITROX-CAPABLE	EASE OF BREATHING	DIFFERENT POSITIONS	WETNESS	BUBBLE INTERFERENCE	EASE OF CLEARING	COMFORT	ADJUSTMENTS		
UNDER \$300																	
DACOR Eagle	\$199	limited lifetime	Italy	unbalanced piston	1 HP 4 LP	unbalanced	none	no	3	3	4	3	3	3	N/A		
DACOR Eagle Sport	\$229	limited lifetime	Italy	balanced diaphragm	2 HP 4 LP	unbalanced	none	no	3	3	4	3	3	3	N/A		
H2ODYSSY Sprint XS	\$249	2-year limited	Taiwan	balanced diaphragm	2 HP 4 LP	balanced	none	up to 40%	3	3	3	3	3	3	N/A		
H2ODYSSY Sprint XL	\$299	2-year limited	Taiwan	balanced diaphragm	2 HP 4 LP	balanced	resistance knob; dive/pre-dive	up to 40%	3	3	3	2	4	3	3		
ZEAGLE Envoy	\$299	limited lifetime	USA	balanced diaphragm	2 HP 5 LP	balanced	dive/pre-dive	up to 40%	3	3	4	3	4	3	3		
\$300 - \$400																	
AERIS Atmos Sport	\$399.95	2-year limited	USA	balanced diaphragm	2 HP 5 LP	balanced	dive/pre-dive	up to 40%	4	3	3	3	4	3	2		
APOLLO Bio A-120	\$389	limited lifetime	Japan	balanced diaphragm	2 HP 4 LP	unbalanced	none	up to 40%	2	3	4	3	3	3	N/A		
DACOR Eagle Pro DPD	\$399	limited lifetime	Italy	balanced diaphragm	2 HP 5 LP	unbalanced	dive/pre-dive	no	3	3	4	3	3	3	3		
DIVE RITE RG2010	\$395	1 year	USA	balanced diaphragm	2 HP 4 LP	balanced	resistance knob; dive/pre-dive	up to 40%	3	3	3	3	4	3	3		
OCEANIC GT/CDX5	\$365	2-year limited	USA	balanced diaphragm	2 HP 4 LP	unbalanced	none	up to 40%	3	3	4	3	3	3	N/A		
OCEANIC O2 Tech	\$379	2-year limited	USA	unbalanced piston	1 HP 4 LP	unbalanced	none	100%	3	3	4	3	4	3	N/A		
ZEAGLE Envoy Deluxe	\$349	limited lifetime	USA	balanced diaphragm	2 HP 5 LP	balanced	resistance knob; dive/pre-dive	up to 40%	3	3	4	3	4	3	3		
ZEAGLE ZX/DS-V	\$399	limited lifetime	USA	balanced diaphragm	2 HP 5 LP	balanced	resistance knob; dive/pre-dive	up to 40%	3	3	3	3	4	3	3		
OVER \$400																	
AERIS Atmos Pro	\$449.95	2-year limited	USA	balanced diaphragm	2 HP 5 LP	balanced	resistance knob; dive/pre-dive	up to 40%	4	2	2	3	3	3	3		
APEKS ATX100	\$649	limited lifetime	UK	over-balanced diaphragm	2 HP 4 LP	balanced	resistance knob; venturi control lever	up to 40%	4	4	4	3	4	4	4		
APEKS ATX40	\$469	limited lifetime	UK	over-balanced diaphragm	2 HP 4 LP	balanced	venturi control lever	up to 40%	4	4	4	3	4	4	3		
APOLLO Bio A-110 Moisturizing	\$499	limited lifetime	Japan	balanced diaphragm	1 HP 3 LP	unbalanced	none	up to 40%	3	3	3	3	4	3	N/A		
ATOMIC AQUATICS B2	\$699	limited lifetime	USA	balanced piston	2 HP 4 LP	balanced	resistance knob	up to 40%	4	4	5	3	4	4	3		
MARES Proton Ice	\$529	limited lifetime	Italy	balanced diaphragm	2 HP 4 LP	unbalanced	none	no	3	3	3	2	4	4	N/A		
OCEANIC Delta 3/TDX5	\$1,250	2-year limited	USA	balanced diaphragm	2 HP 4 LP	balanced	resistance knob; dive/pre-dive	up to 40%	3	3	3	3	4	3	3		
OCEANIC Omega 2/DX4	\$499	2-year limited	USA	balanced diaphragm	2 HP 4 LP	balanced	none	up to 40%	4	3	3	4	2	4	N/A		
OCEANIC Zeta/CDX5	\$609	2-year limited	USA	balanced diaphragm	2 HP 4 LP	balanced	none	up to 40%	3	2	4	3	3	3	N/A		
POSEIDON Xstream Dive	\$655	2 years	Sweden	balanced diaphragm	2 HP 5 LP	unbalanced	none	no	3	4	4	3	2	4	N/A		
TUSA RS240	\$449	limited lifetime	Japan	balanced diaphragm	2 HP 4 LP	unbalanced	resistance knob	up to 40%	4	4	4	3	4	4	4		

REGULATOR TESTING: IN THE WATER

Scores of ergonomic criteria are weighted by importance, as follows:

MOST IMPORTANT**EASE OF BREATHING:** How well does the regulator deliver air while the diver is propelling himself forward in the standard swimming position?**DIFFERENT POSITIONS:** How does the regulator breathe when the diver is in a heads-up or face-down position?**WETNESS:** Does the regulator breathe wet or dry during normal or odd swimming positions?**MODERATELY IMPORTANT****BUBBLE INTERFERENCE:** Taking into account that all regulators produce bubble interference to a certain degree, when looking down, straight ahead, up at a 45-degree angle and straight up, do the bubbles rise into the diver's field of view at a rate that is average, less than average or greater than average?
EASE OF CLEARING: Divided into two parts: 1) How

difficult is it to find and use the purge, and how forceful is the purge? 2) How much force is required to clear the regulator by using the blowing method?

CONVENIENCE ELEMENTS**COMFORT:** Also divided into two parts: 1) How comfortable is the mouthpiece? How does the second stage feel in the mouth? 2) Does hose length and stiffness restrict head movement or otherwise cause discomfort?**ADJUSTMENTS:** If the regulator has diver-controlled adjustments, how easy are they to find, grip and turn? Do they do their job in a reasonable manner?

RATING SYSTEM FOR ERGONOMIC PERFORMANCE: 5=EXCELLENT 4=VERY GOOD 3=GOOD 2=FAIR 1=POOR



BREATHING SIMULATOR SCORES

MANUFACTURER Product Name	A	B	C	D	TOTAL
UNDER \$300					
DACOR Eagle	4	3	4	3	14
DACOR Eagle Sport	4	4	4	4	16
H2ODYSSEY Sprint XS	4				4
H2ODYSSEY Sprint XL	5	3	3		11
ZEAGLE Envoy	5	5	5	5	20
\$300 - \$400					
AERIS Atmos Sport	5	3	4		12
APOLLO Bio A-120	3				3
DACOR Eagle Pro DPD	5	4	4	4	17
DIVE RITE RG2010	5	4	4		13
OCEANIC GT/CDX5	5	3	4	3	15
OCEANIC O2 Tech	5	4	4	3	16
ZEAGLE Envoy Deluxe	5	5	5	5	20
ZEAGLE ZX/DS-V	5	4	4	4	17
OVER \$400					
AERIS Atmos Pro	5		3		8
APEKS ATX100	5	5	5	5	20
APEKS ATX40	5	5	5	5	20
APOLLO Bio A-110 Moisturizing	3				3
ATOMIC AQUATICS B2	5	5	5	5	20
MARES Proton Ice	5	4	4	4	17
OCEANIC Delta 3/TDX5	5	3	3	3	14
OCEANIC Omega 2/DX4	5				5
OCEANIC Zeta/CDX5	5	3	3	3	14
POSEIDON Xstream Dive	5	4	5	4	18
TUSA RS240	4		3		7

Note: Blank spaces indicate that the regulator was not able to achieve the RMV/depth category without exceeding the 25 millibar test limits on either inhalation or exhalation.

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CURRENTS, P. 24 • "Santa's Diving Elves," p. 27 > If you'd like to contribute to Toys for Children, send non-battery-operated toys, school supplies and personal-hygiene items to **Coral Rewards, Attention Jimmy Atkinson, P.O. Box 542484, Dallas, Texas 75354-2484**. Gifts should be new or like-new and unwrapped. Suggested items are soccer balls, basketballs, dolls, books, stuffed animal, soap, shampoo, toothpaste, toothbrushes, hair clips, paper, pencils, pens and shoes. For more information, visit www.toysforthechildren.org or call Jimmy Atkinson at (972) 221-5282, or e-mail him at coralrewd@aol.com. To purchase raffle tickets, go to www.scubatoys.com. Each \$5 ticket makes you eligible to win free dive equipment or dive vacations to the Maldives, Red Sea or Bay Islands. **"Marathon Man," p. 29** > To contribute, mail donations to: **The Alyssa M. Ennis Fund, c/o Sgt. M. Nichols, Savannah Police Dept. Traffic Unit, 201 Habersham St., Savannah, GA 31401**.

SIMULATOR CHART DEFINITIONS

COLUMN A > 37.5 RMV @ 132 fsw: The maximum recreational depth at a somewhat aggressive breathing rate.

COLUMN B > 75 RMV @ 132 fsw: The maximum recreational depth looked at as 1) an extremely heavy work rate or 2) loosely simulating two divers buddy breathing at a somewhat aggressive breathing rate.

COLUMN C > 62.5 RMV @ 165 fsw: The European conformance standard EN250. This is also the depth and breathing rate commonly used by manufacturers when determining a regulator's performance.

COLUMN D > 62.5 RMV @ 198 fsw: The U.S. Navy's Class A test depth and breathing rate, but using a lower high-pressure supply pressure.

WARNING: Although we're using excessive depths to show both how these regulators perform and their reserve potential, this is not to suggest that you should take them that deep. Scuba Diving doesn't recommend diving deeper than the recreational depth limits.

SIMULATOR CHART SCORING

Breathing simulators are great indicators of a regulator's abilities, as expressed in EXT WOB (External Work of Breathing, the sum of the inhalation and exhalation effort expressed in joules per liter, or J/L). However, with a machine as accurate as the ANSTI simulator, competing regulators produce a litany of J/L scores differing from each other by a matter of tenths and even hundredths of a point.

So for the sake of simplicity, and to avoid losing perspective in the original goal (which is to isolate good-breathing regulators) by becoming obsessed with decimal points, we've translated J/L scores into three basic classifications: Good, Very Good and Excellent. Here's what each represents:

3 = GOOD > Any regulator that can achieve the breathing rate/depth category with an EXT WOB of less than 3.0 J/L (the EN250 limit).

4 = VERY GOOD > Any regulator that can achieve the breathing rate/depth category in half or less of the EN250 standard limit, or an EXT WOB of 1.5 J/L.

5 = EXCELLENT > Any regulator that can achieve the breathing rate/depth category with an EXT WOB of 1.0 J/L or less. (While tenths or hundredths of a point of variation between WOBs is detectable only by a machine, a diver in the water can in fact discern the difference in breathing of one-half a J/L, especially when diving at greater depths. So here we give engineers credit where credit's not only due but actually noticeable to a diver.)

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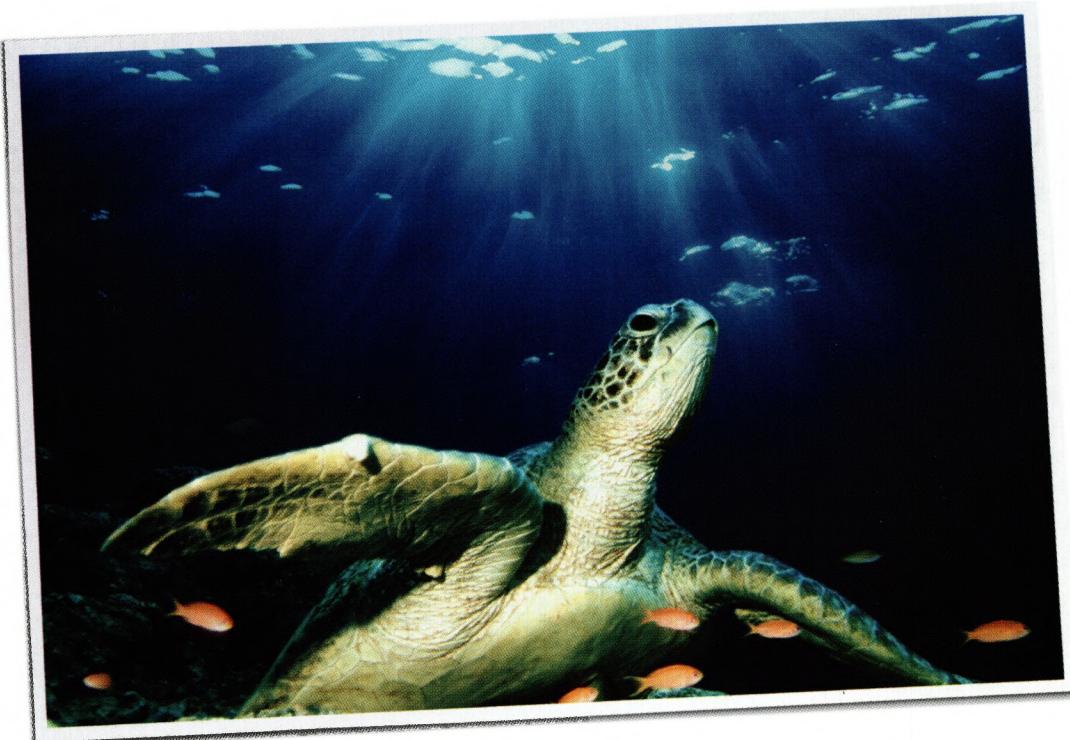
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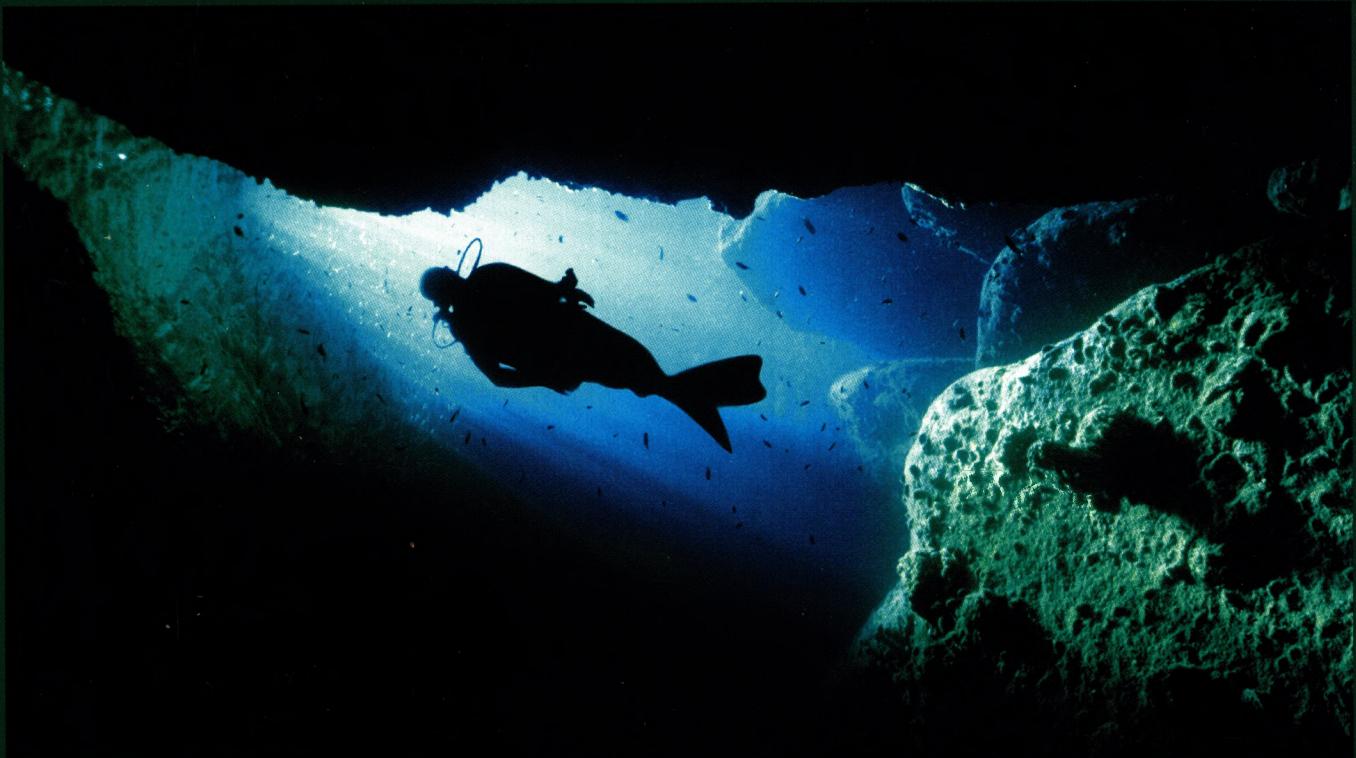


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